Ears and Eyes in the Sky: The Evolution of Manned Airborne ISR

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Thesis

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Approval Page

The undersigned certify that this thesis meets masters-level standards of research, argumentation, and expression.

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About the Author

Major Tyler W. Morton enlisted in the Air Force as a Spanish Airborne Cryptologic Linguist in 1991. After serving five years as a linguist and accumulating over 2,000 flight hours on the RC-135, he completed a degree in Spanish from the University of Nebraska at Omaha and was commissioned in 1998. Following assignments at USEUCOM's Joint Analysis Center, NORAD-USNORTHCOM's J2 directorate, and a one-year stint at the Joint Interrogation and Debriefing Center in Iraq, he returned to the RC-135 as the Assistant Director of Operations at the 97th Intelligence Squadron at Offutt AFB, Nebraska. In 2008, he was selected to stand-up and command the Air Force's first MC-12 PROJECT LIBERTY detachment. Following his detachment command, Major Morton was selected to attend Air Command and Staff College and, subsequently, the School of Advanced Air and Space Studies. His next assignment is to the Air Staff A-2.

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Abstract

The fundamental purpose of this thesis is to enable students of air power to understand and appreciate the evolution of airborne ISR. The manner in which airborne ISR evolved and its subsequent importance to today's militaries has contemporary relevance. As the United States advances into a new postwar era, evaluating the historical treatment of ISR is important to informing current decisions. The thesis also aims to highlight the various challenges faced by decision makers dealing with fiscally limited budgets. There has long existed a question of whether airborne ISR forces are best suited as strategic intelligence collection platforms or if their true purpose – indeed, the initial reason they were established – is to provide intelligence directly to warfighters. While this distinction may seem trivial to some, within the airborne ISR community, tactical intelligence collection often requires distinct aircraft, and more importantly, distinctly trained personnel. As the USAF faces a period that is certain to be one of fiscal austerity, ISR leaders must make the distinction clear. In addition to recounting the evolution of airborne ISR, this thesis provides historical case studies of both strategic and tactical intelligence collection. The hope is that by reading this thesis, ISR leaders will have a better-informed appreciation of the travails of airborne ISR over history and will use the past to inform future decisions.

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Introduction

Nothing is more worthy of attention of a good general than the endeavor to penetrate the designs of the enemy.

Niccolo Machiavelli

The quest for military intelligence is as old as war itself. Military commanders dating to Biblical times understood the role superior information played in the formulation of military strategies. In preparation for his invasion of Canaan, Moses dispatched spies to "see what the land is like, and whether the people who live there are strong or weak, few or many."[1] Not long thereafter, the ancient Greek Demosthenes adroitly used spies and scouts to help secure victory in the Battle of Sphacteria.[2] George Washington's spy networks in the American Revolutionary War kept him apprised of British moves and undoubtedly contributed to American victory.[3] In the American Civil War, J.E.B. Stuart's failure to provide intelligence on the Union Army contributed to the Confederate defeat at Gettysburg.[4]

While the intelligence provided in the above examples contributed to the success or failure of their respective commanders, the information was limited to what the spies and scouts could observe from the ground. The earliest military commanders identified the value of the high ground. First desired for its advantages in combat, the high terrain also provided the best location from which to observe enemy movements. Until the late

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[1] *The Airman's Pocket Bible* (Nashville, TN: Holman Bible Publishers, 2004), 127.
[2] Thucydides, *The Landmark Thucydides*, ed. Robert B. Strassler (New York, NY: Free Press, 1996), 239-244.
[3] For further information on Washington's use of spies see Alexander Rose, *Washington's Spies: The Story of America's First Spy Ring* (New York, NY: Bantam Books, 2006).
[4] Stephen W. Sears, *Gettysburg* (Boston, MA: Houghton Mifflin, 2003), 139.

18th century, man's uppermost vantage point was limited to the highest piece of land he could find. In a French field in 1783, the brothers Montgolfier shattered that constraint. Their successful test of a hot air balloon launched a new era of warfare. Within days, visionaries recognized the military utility of the new invention and within a decade, the French Army had begun using the balloon to conduct the world's first military intelligence, surveillance, and reconnaissance (ISR) flights. No longer would man's view be restricted to the ground. The air provided the highest view and the ultimate reconnaissance advantage.

While initially conceived as an intelligence collection platform, the new air vehicles offered many possibilities. Shortly after seeing the balloon for the first time, Benjamin Franklin highlighted its potential for ISR, transport, and strategic bombing. The rudimentary nature of the earliest balloons prompted inventors to improve upon the design. The need to control the balloon resulted in the powered dirigible which ultimately led to heavier-than-air craft. In 1903, with the successful flight of the Wright Flyer, the airplane was poised to launch ISR to great significance in military operations. Airborne ISR success in World War I would set the foundation for the evolution of airborne ISR.

By conducting a thorough evaluation of the lifespan of airborne ISR – from the Montgolfier experiments through Operation Desert Storm – the fundamental purpose of this thesis is to analyze the significant impact airborne ISR has had throughout history. Through a historical-based study that begins with the invention of the Montgolfier balloon, the story follows the history of the use of aircraft as ISR platforms. The time frame the thesis covers is vast, but to properly examine the evolution of airborne ISR, the growing pains of its development must be understood. As with any new capability, airborne ISR advocates had difficulty sustaining the momentum that its capability suggested in both world wars.

Unprecedented success in World War I was followed by retrenchment and a return to isolationism. The concomitant personnel drawdown combined with crushing world depression severely limited interwar ISR development. Additionally, interwar airmen of the United States Army Air Corps focused almost exclusively on the development of the long-range bomber. As World War II began, airborne ISR forces possessed nothing more than a rudimentary capability. The exigencies of war, however, would cause a precipitous increase in ISR capabilities. By the end of the war, the United States had developed an extremely capable airborne signals intelligence (SIGINT) and imagery intelligence (IMINT) force.

Following World War II, the United States military again faced personnel drawdowns and budgetary constraints. This time, however, the threat posed by the Soviet Union (USSR) would permit airmen to maintain a capable, though small, airborne ISR force. Through the second half of the 1940s, enterprising airmen advanced both electronic intelligence (ELINT) and IMINT capabilities as they struggled to develop strategic intelligence on America's new foe. Throughout the war in Korea, airborne IMINT played an important role providing tactical imagery support directly to air and ground forces. In the latter half of the Korean War, airborne SIGINT also became an important contributor. Starting with a basic capability, airborne SIGINT advanced through the war. By 1953, it had evolved sufficiently to allow SIGINT airmen to develop the first threat warning, or advisory support, capability.

As opposed to the responses following both world wars, following the Korean War, ISR airmen did not forget the lessons they had learned. Airborne ISR became the key provider of information on the USSR. Airborne SIGINT sorties along the periphery of Soviet-held territory and U-2 flights directly over the USSR gave American policy makers the intelligence they needed to always maintain the upper hand on their Soviet counterparts. U-2 IMINT flights over the USSR shattered the

bomber gap myth and in 1962, gave the United States the advanced warning it needed to deflect a Soviet attempt to install nuclear weapons in the Western Hemisphere.

By the time full-scale American involvement in Vietnam began, it is safe to say that airborne ISR had transformed. Airborne IMINT was prolific throughout the war and airborne SIGINT provided the information American pilots needed to turn the tide during the Linebacker operations. Again, after Vietnam, while other forces atrophied, airborne ISR continued to advance its capabilities. By Operation Desert Storm, it had become an integral part of the joint force providing near real-time intelligence directly to the warfighter through both advanced tactical digital communication links and direct radio communications. The ultimate high ground had finally been conquered. The eyes and ears of the commander were extended – instantaneously – to allow him to view, and hear, unprecedented levels of detail. Airborne ISR had completed its evolution.

By starting at the beginning – with the Montgolfier balloon – this thesis follows the course of airborne ISR evolution. It tracks the trials and tribulations, the ups-and-downs, the advances, and the setbacks over which ISR airmen ultimately triumphed. Understanding the historical path of airborne ISR will help future generations guide its use and continued development. As the USAF faces a new postwar period, developing a complete comprehension of the past successes and failures will prove useful to our future decision-making.

Historiography

The thesis also serves to fill an historical gap. Surprisingly, the list of works that discuss the evolution of airborne ISR is thin. Indeed, no one book or paper – that the author could find – exists that provides a comprehensive summary of airborne ISR such as that presented in this thesis. Several prominent works contain significant sections on airborne ISR. Larry Tart's two books, *The Price of Vigilance* and *Freedom Through*

Vigilance, provide the most comprehensive review of airborne ISR dating from World War II, but his focus is solely on airborne SIGINT. *Piercing the Fog* briefly discusses World War II development of airborne ISR, but the treatment is only a minor part of a larger chapter on SIGINT and imagery interpretation. Rob Ehler's fantastic history, *Targeting the Third Reich*, touches briefly on the development of airborne IMINT capabilities during World War II, but does not mention airborne SIGINT. John Farquhar's *A Need to Know* provides an outstanding description of the development of airborne ELINT, but it does not discuss airborne COMINT. In perhaps the best description of the early development of airborne SIGINT, Aileen Clayton's book, *The Enemy is Listening*, discusses the first placement of German linguists on American bombers and electronic intelligence (ELINT) aircraft in the Mediterranean campaign. Again, however, Clayton's description is only a small part of a larger narrative concerning the role of SIGINT in the war.

This thesis hopes to provide an important contribution to this body of literature by focusing solely on the evolution of airborne ISR. By cobbling together information from secondary sources and combining it with primary sources from the Air Force Historical Research Agency, National Archives, Library of Congress, and through Freedom of Information Act (FOIA) requests, the author hopes to present a study that will both educate and inform the ISR professional and interested historian.

Overview

Chapter One examines the invention of the lighter-than-air balloon and tracks its early metamorphosis into an airborne ISR platform. Dating from shortly after its inception, man saw the balloon's potential as a military force enhancer. The chapter analyzes the military proponents' thoughts on the potential uses of the balloon and examines how their thoughts were put into action by their respective nations. It

concludes with a look at how advancements in balloon design – and the development of the camera and telegraph – truly made balloons viable ISR platforms.

The first half of Chapter Two continues the examination of the development of the balloon. As the weaknesses of the captive, or static, balloon became apparent, balloon designers sought to make them mobile and navigable. The chapter highlights the various designs that ultimately resulted in the well-known German Zeppelin dirigible. The second half of Chapter Two focuses on the invention of the heavier-than-air aircraft and its subsequent adoption by the United States Army. This chapter includes secondary source material, but also provides interesting perspective directly from the writings of Benjamin Foulois – one of the first American airpower zealots. As the chapter concludes, World War I is dawning. The American military has purchased airplanes and balloons, but has not made significant progress towards their incorporation into the Army's order of battle.

Chapter Three focuses on airborne ISR's first trial of fire – World War I. Beginning with three early instances in which airborne ISR was a major contributor, the chapter follows its use and development throughout the war. This chapter is also where we first start to see delineation between the strategic and tactical use of ISR. Before the stalemate of trench warfare, airborne ISR was used almost exclusively in a tactical role to provide immediate information about the movement of enemy troops. When the lines stabilized, however, the role of ISR shifted to a more tactical focus. Airborne spotting for friendly artillery quickly became the ISR aircraft's main function. This chapter also describes how airborne ISR – and the need to deny its use to the adversary – ushered in the fighter aircraft and anti-aircraft artillery. The discussion then turns to the Germans' failed use of dirigibles as deep-penetrating strategic ISR platforms. Finally, the chapter covers the American entry into the war and follows its fitful attempts, first with balloons, and then

with airplanes, to conduct airborne ISR. The chapter concludes with a description of the enhancements made to airborne ISR aircraft during the war.

Chapter Four details the meteoric growth of airborne ISR during World War II. Despite the indubitable positive effects it had during World War I, personnel drawdowns, budgetary limitations, and intra- and interservice bickering left airborne ISR unprepared when World War II began. This chapter begins by examining interwar air power evolution of the United States, Great Britain, and Germany. It follows all three nations' early war attempts to develop capable airborne IMINT and pays particular attention to the airframes that all three nations chose. The next section of the chapter follows the development of American air intelligence and examines how the need to support the United States Army Air Forces' (USAAF) drive for strategic bombing allowed the USAAF to create an independent intelligence function. The chapter then examines the cooperation between the American and British intelligence apparatuses during the early stages of the war. A thorough evaluation of the development of airborne ELINT and COMINT platforms during the latter stages of the war concludes the chapter.

Chapter Five's focus is the Cold War period and the exclusive use of airborne ISR to provide strategic intelligence on the USSR. It catalogs American airborne ISR's development immediately following the war and follows it through the eventual development of the U-2, SR-71, and RC-135. The main purpose of the chapter is to highlight the strategic role that airborne ISR filled during the entirety of the Cold War. It explains how the need to conduct strategic air warfare against the USSR drove the development of airborne ISR aircraft and tactics.

Chapter Six examines three conflicts in which USAF airborne ISR was asked to provide tactical intelligence directly to the warfighter – the Korean War, the Vietnam War, and Operation Desert Storm. The intent of this chapter is to prove that even though airborne ISR was built with a

singular strategic focus – the USSR – it was flexible enough to provide competent tactical support when called upon. The first case, the Korean War, shows that focus on the USSR created difficulty for airborne ISR early in the war. A lack of linguists, aircraft, analysts, and photo interpreters plagued initial efforts. After an early buildup period, however, airborne IMINT and SIGINT became major contributors. For IMINT, a rapid tasking and dissemination system was created that ensured imagery quickly arrived in the warfighters' hands. For SIGINT, enterprising ISR professionals developed an innovative direct threat warning system that enabled American pilots to have advanced warning of enemy aircraft locations and intent.

The second example in Chapter Six looks at the Vietnam conflict. As opposed to Korea, the USAF entered Vietnam well prepared to provide tactical airborne ISR to ground and air commanders. Building on the lessons of the Korean War, airmen developed a rapid imagery dissemination process and SIGINT professionals replicated the direct threat warning system they established in Korea. This time, however, the system was fed by multiple types of airborne SIGINT platforms. The U-2, the RC-135, and the C-130A-II all contributed.

Chapter Six concludes by examining the success of airborne ISR in Operation Desert Storm. Following Vietnam, the USAF built on its ISR successes by further improving its ISR forces. RF-4Cs were dedicated exclusively to tactical IMINT missions and many of the USAF's airborne ISR assets were upgraded to include automated digital data links and direct radio communications with ground and air forces. These enhancements resulted in unprecedented airborne ISR successes during the conflict.

Purpose

In conclusion, the main purpose of this thesis is to understand the evolution of airborne ISR. Although it is primarily an historical piece, the manner in which airborne ISR evolved and its subsequent importance to

today's militaries has contemporary relevance. As the USAF approaches a period of uncertainty regarding the future use of airborne ISR, hopefully this thesis will help guide future decision-making. Fiscal austerity and doubt about potential adversaries will mark the post-Iraq and Afghanistan era. USAF leaders face difficult decisions as they plot a new ISR strategy; understanding the past should help inform the future.

A second purpose of this thesis is to highlight the challenges created by the dual use of airborne ISR assets. While current USAF ISR doctrine rightfully discusses the ability of ISR to provide strategic and tactical level ISR simultaneously[5], at the squadron level this requirement provides training challenges for the commanders charged with providing airborne ISR forces. The level of training required to produce strategic intelligence is vastly different from that required of tactical support forces. As will be seen, when collecting strategic intelligence, ISR airmen generally have ample time to analyze their collection to determine its accuracy. This allows for a more precise level of intelligence, but results in a slower process. With tactical intelligence, the opposite is true. Information collected will often determine life or death for an aircrew or a soldier on the ground; the luxury of time is not on the side of the tactical intelligence collector as their intelligence must be delivered in near real-time. Each type – strategic and tactical – requires airborne ISR airmen of differing capabilities and mindsets. In times of constrained budgets and personnel, training such dissimilarities is problematic.

Finally, the requirement to prosecute both strategic and tactical airborne ISR will stretch ISR airmen thin. The Cold War's singular focus allowed the preponderance of airborne ISR to focus on the USSR. Almost immediately following the Cold War, the United States became involved in the Middle East. This Middle East focus has endured for the last 20 years. Following withdrawal from Iraq and Afghanistan, the United

[5] Air Force Doctrine Document 2-0, *Global Integrated Intelligence, Surveillance, and Reconnaissance Operations*, 6 January 2012, 1.

States must assess where its airborne ISR force should focus. During the Cold War, a singularly focused force struggled when required to switch to a tactical focus. As will be seen in chapter 6, narrowly focused ISR airmen can become effective tactical collectors; it simply takes time for them to transition. USAF ISR strategists must consider this factor as they plot the post-Iraq, post-Afghanistan future.

Chapter 1

The Highest Hill

What is called 'foreknowledge' cannot be elicited from spirits, nor from gods, nor by analogy with past events, nor from calculations. It must be obtained from men who know the enemy situation.

Sun Tzu

For millennia, men dreamed about the ability to soar above the earth. Countless scientists and theoreticians even conceived rudimentary aircraft designs to defeat gravity. As the need for information about an adversary has always been paramount, many recognized that the ability to rise above the land conferred a distinct military advantage – the highest hill. While many had theorized, none had been able to solve the mystery of flight. Man's quest for enhanced information about the enemy took a major leap forward above a French field on 5 June 1783.[1] On that day, the brothers Montgolfier conducted the first ever successful demonstration of the hot air balloon. While rudimentary in nature and using nothing more than burnt straw to provide the gas to lift the balloon, the Montgolfier craft ignited a flurry of experimentation with various fuel types and payloads. These enhancements to the Montgolfier design eventually led to a stable aircraft that could carry a significant amount of weight and that could be controlled by a "pilot."

Many quickly recognized the military utility of this new invention. Scarcely ten years after the initial Montgolfier experiment, the French military adopted the balloon and attempted to use it in campaigns during and following the French Revolution. This initial use of the air in warfare

[1] Frederick Stansbury Haydon, *Aeronautics in the Union and Confederate Armies: With a Survey of Military Aeronautics Prior to 1861* (Baltimore, MD: The Johns Hopkins Press, 1941), 1.

was the watershed event from which all future military aviation grew. The technology quickly proliferated to other nations prompting a race to further take advantage of the new medium. This eventually led to the invention of winged-aircraft, setting the stage for an unprecedented increase in the aircraft's military utility. Through an extensive examination of the evolution of the use of balloons for reconnaissance spanning the earliest experiments through the end of the 19th century, this first chapter will establish the foundation for the paper's subsequent discussion of manned airborne ISR operations.

The precise beginning of the military use of lighter-than-air craft is not certain. Throughout history, thinkers from Ovid to Archimedes envisioned man overcoming gravity and ascending skyward. Ovid imagined bird-like wings partially constructed of wax, while Archimedes conceived elaborately designed models of how air vehicles could potentially function.[2] While these designs were conceptual and not inherently military-oriented, there is evidence that lighter-than-air flight – with a military purpose – had already occurred in China at least 1700 years before the Montgolfier experiments. According to British historian Basil Collier, the Chinese used man-lifting kites to conduct airborne reconnaissance as early as the Christian era.[3] As Chinese mastery of kites is common knowledge, these stories are not beyond the possible. In his epic work, *Kites: An Historical Survey*, Clive Hart augments Collier's assertion with a discussion regarding the details of the Chinese method for communicating the information they gained from their manned kite reconnaissance.[4] Unfortunately, documentation of these early Chinese pioneering efforts is sparse and renders Chinese use of kites as ISR platforms unconfirmed. What can be certain is that flight has infatuated

[2] Edwin J. Kirschner, *Aerospace Balloons: From Montgolfier to Space* (Fallbrook, CA: Aero Publishers, Inc., 1985), 7.
[3] Basil Collier, *A History of Air Power* (Oxford, England: Macmillan Publishing Co., 1974), 1.
[4] Clive Hart, *Kites: An Historical Survey* (Mount Vernon, NY: P.P. Appel Publishing, 1982), 27.

mankind for thousands of years but did not become practical in the West until that June day in the fields of France.

Following that first flight, the brothers Montgolfier continued to experiment with different types of balloons, and more importantly, with various payloads. Three weeks after their successful demonstration, Joseph Montgolfier attached a basket to his balloon and sent aloft a sheep, a duck, and a rooster – the world's first known air cargo.[5] Once Montgolfier had demonstrated the feasibility of carrying items with his balloons, the natural progression was for a man to ascend in the balloon. On 15 October 1783 – scarcely four months after the brothers Montgolfier first proved the concept of flight – the Frenchman Jean-François-Pilâtre de Rozier became the world's first known human being to ascend in a lighter-than-air craft.[6] These, however, were only flights in the loosest sense of the word. In reality, they were nothing more than tethered ascensions. The first untethered flight took place, with the King and Queen of France and the United States Ambassador to France Benjamin Franklin in attendance, on 21 November 1783, when de Rozier and French Army infantry Captain Marquis Francois Laurent d'Arlandes flew for twenty-five minutes achieving a height of at least 500 feet.[7] As these men flew untethered and they continually had to provide fuel to the balloon to keep it aloft, they are often recognized as the world's first pilots.[8]

With men now flying through the air and having gained a new perspective of the land beneath them, thought quickly turned to the military utility of this new capability. Though foreseen over a hundred years previously by Portuguese monk and inventor Francesco de Lana,[9]

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[5] Haydon, *Aeronautics in the Union and Confederate Armies, 1.*
[6] Ibid., 1.
[7] Kirschner, *Aerospace Balloons*, 11.
[8] Lennart Ege, *Balloons and Airships,* (New York, NY: Macmillan Publishing Co. Inc., 1974), 98.
[9] Egbert Torenbeek and H. Wittenberg, *Flight Physics: Essentials of Aeronautical Disciplines and Technology, with Historical Notes* (New York, NY: Springer, 2009), 5.

historians credit the Frenchman André Giraud de Villette with being the first early promoter of the use of aircraft to conduct aerial reconnaissance in warfare.[10] De Villette accompanied de Rozier on a balloon ascension two days after the latter's initial success. Following his flight, de Villette wrote a letter to *Le Journal de Paris* relating the events. In the letter, de Villette provides what could be the first known, documented advocacy for manned airborne ISR, stating, "From that moment I was convinced that this apparatus, at little cost, could be made very useful to an army for discovering the position of its enemy, its movements, its advances, its dispositions, and that this information could be conveyed by a system of signals, to the troops looking after the apparatus."[11] The idea of using the balloon as a weapon of war was thus publicly expressed within four months of its invention and five days after the first ascent by a human being.[12]

De Villette's initial musings were amplified less than a month later by the Englishman William Cooke. Cooke hypothesized about the potential use of the balloon in war and made a case for the British military to adopt it for use in reconnaissance and long distance signaling.[13] The following year, an anonymous French author further explored the use of the balloon as an apparatus of warfare. This writer forecasted sweeping changes to the methodology of warfare due to the invention of this new device suggesting a multitude of uses, including: reconnaissance, observation, map making, and interestingly the use of captured enemy scouts to provide details on the location of the enemy armies.[14] Englishman Thomas Martyn also wrote in great detail about

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[10] Haydon, *Aeronautics in the Union and Confederate Armies*, 2.
[11] Charles Frederick Snowden Gamble, *The Air Weapon: Being Some Account of the Growth of British Military Aeronautics from the Beginnings in the Year 1783 Until the End of the Year 1929, Volume 1* (Oxford, England: Oxford University Press, 1935), 9.
[12] Haydon, *Aeronautics in the Union and Confederate Armies*, 2.
[13] William Cooke, *The Air Balloon: Or a Treatise on the Aerostatic Globe, Lately Invented by the Celebrated Mons. Montgolfier, of Paris* (London, England, 1783), 24-26.
[14] As cited in Gamble, *The Air Weapon*, 9.

what he foresaw as the most important use of the balloon. In a short book, Martyn detailed the use of balloons for reconnaissance and signaling, particularly at night. Martyn's vision is unique as he also discusses using balloons as part of naval fleets, or task forces. He saw the use of the balloon as a new way to communicate orders to ships in the task force. In a day before wireless communication, the ability for all ships – or army units for that matter – to receive higher headquarters orders simultaneously was extremely important.[15]

American thought about balloons as instruments of war also began with the early Montgolfier demonstrations. Having witnessed the de Rozier and d'Alarndes manned flight along with a 27 August flight conducted by Jacques Alexandre César Charles, Benjamin Franklin began corresponding about his vision for the future. In a letter dated 30 August 1783, Franklin provided Sir Joseph Banks, President of the British Royal Society, with his initial reaction to balloon flight. In the letter, Franklin described in great detail the balloon materials, fuel, and payload.[16] In this initial missive, he highlighted the events surrounding Charles' successful flight and hypothesized about potential uses of the balloon. He guessed that in time people will "keep such globes anchored in the air, to which…they may draw up game to be preserved in the cool, and water to be frozen when ice is wanted; and that to get money, it will be contrived to give people an extensive view of the country…"[17] Franklin's initial musings do not include speculation regarding the balloon's military utility. He continued to follow the balloon's progress and in a letter to Dr. Richard Price – another member of the British Royal Society – Franklin commented that balloons were now capable of

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[15] Thomas Martyn, *Hints of Important Uses to be Derived from Aerostatic Globes* (London: England, 1784), 8.
[16] Benjamin Franklin to Sir Joseph Banks, letter, 30 August 1783, *The Complete Works of Benjamin Franklin*, vol. VIII, ed. John Bigelow, (New York, NY: The Knickerbocker Press, 1888), 328.
[17] Ibid., 332-333.

carrying a one thousand pound payload.[18] Perhaps the increased carrying capacity of the balloon, combined with the fact that men were now flying in them, caused Franklin to ponder its military uses. In a subsequent letter to Banks, written on 21 November 1783 – the same day he witnessed the de Rozier/d'Arlandes flight – Franklin speculated about various instances in which he saw balloons being valuable to armies. In this letter, he discussed the relatively low cost of the balloon as compared to the other military services. Additionally, he mentioned its potential to view an enemy's army, convey "intelligence" out of a besieged town, and the ability to signal over great distances.[19]

Franklin continued these initial speculations about early airpower in a letter to the Dutch scientist Jan Ingenhousz. In this letter, Franklin made perhaps the first cost comparison between aircraft and ships when he stated, "Five thousand balloons, capable of raising two men each, could not cost more than five ships of the line…"[20] Franklin's comments were meant to show the relative ease by which a country could invade another through the use of airpower, but they are eerily similar to claims made by airpower pioneers during the early 20th century. Perhaps more importantly, Franklin also raised the possibility that the balloon could completely eliminate war. In the Ingenhousz letter, he postulated that the balloon could potentially convince leaders of the "folly of wars" due to the inability to defend against air attack.[21] These words, while Franklin's, could have just as easily been taken from a manuscript written by Giulio Douhet.

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[18] Benjamin Franklin to Doctor Richard Price, letter, 16 September 1783, *The Complete Works of Benjamin Franklin*, vol. VIII, ed. John Bigelow (New York, NY: The Knickerbocker Press, 1888), 359.
[19] Benjamin Franklin to Sir Joseph Banks, letter, 21 November 1783, *The Complete Works of Benjamin Franklin*, vol. VIII, ed. John Bigelow (New York, NY: The Knickerbocker Press, 1888), 377.
[20] Benjamin Franklin to Doctor Jan Ingenhousz, letter, 16 January 1784, *The Complete Works of Benjamin Franklin*, vol. VIII, ed. John Bigelow (New York, NY: The Knickerbocker Press, 1888), 433.
[21] Ibid., 433.

While Franklin was pondering non-kinetic military uses of the balloon, it was, surprisingly, the poet Philip Freneau who was perhaps the first American to discuss the use of the balloon as a true instrument of war. In his poem, *The Progress of Balloons*, Freneau – forecasting the future exploits of Colonel Billy Mitchell – wrote of a great French air armada attacking the British Navy from the air and also discussed the British using balloons to bomb the United States in a future war between the two nations.[22]

Despite the early excitement surrounding the invention of the balloon, French leaders were not quick to integrate it into their forces. After overthrowing King Louis XVI, the nascent French Republic was desperate to employ any means that would help it keep its loose hold on power. Internal disputes, general discontent, and the ever-present threat of foreign war contributed to the revolutionary government's willingness to expand its military capability in novel ways. In late 1793, Guyton de Morveau proposed the use of balloons as observation platforms to aid French armies.[23] Additionally, about the same time, Joseph Montgolfier began to advocate for the use of balloons as bombers and proposed a bombing plan for the breaking of the Siege of Toulon.[24]

After hearing the persuasive arguments of de Morveau and Montgolfier, on 25 October 1793, the French government passed an act that ordered both the further examination of the utility of using balloons in the army and the construction of a test balloon.[25] Jean Marie-Joseph Coutelle and Nicolas Conté were placed in charge of the project and built what can be called the world's first military aircraft.[26] Coutelle and Conté conducted multiple demonstrations of their balloon and developed a

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[22] Philip Freneau, "The Progress of Balloons," in *The Poems of Philip Freneau: Poet of the American Revolution*, vol. II, ed. Fred Lewis Pattee (Princeton, NJ: The Princeton University Library, 1903), 276.
[23] Ege, *Balloons and Airships*, 106.
[24] Gamble, *The Air Weapon*, 10.
[25] Haydon, *Aeronautics in the Union and Confederate Armies*, 6.
[26] Ege, *Balloons and Airships*, 106.

system for communicating the intelligence that would be gained from their flights. With minimal input from the French military, they devised a system whereby messages were sent to the ground either by flag communications or by lowering written messages in small bags weighted with sand. On 29 March 1794, having witnessed a display of the balloon and having been convinced of its usefulness to the army, the Committee of Public Safety passed an act creating a balloon corps in the French Army.[27] Three days later, on 2 April 1794, the same committee established the corps' first company; the *1er Compagnie d'Aérostiers.* The world's first airborne reconnaissance outfit was born.[28]

Along with the authority to operate balloons, the Committee of Public Safety established tactical objectives for the balloon corps. These objectives required the balloon corps to "put at the disposal of the general all the services that can be furnished by the art of aeronautics: (1) to clarify the enemy's marches, movements, and plans; (2) to transport quickly signals previously agreed-upon with the major generals and commanding officers in the field; (3) finally, as circumstances required, to distribute public notices in territory occupied by the despots' henchmen."[29] While the first two are commonly recognized missions of the early balloons, the third, distribution of propaganda, is unique and shows the extent of French thinking about the various utilities of the balloon. Of note, there is no mention of using the balloons as bombers. Whether the French simply had not tested the concept or whether the idea simply had not evolved is unknown. What can certainly be ascertained, however, is that the initial military use of the balloon – and thus the aircraft – was undoubtedly for intelligence purposes.

Scarcely a week after the balloon company's establishment, the French government dispatched it to the northern city of Maubeuge. The

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[27] Ibid.
[28] Haydon, *Aeronautics in the Union and Confederate Armies*, 8.
[29] Arnold van Beverhoudt, *These are the Voyages* (St. Thomas, VI: Lulu Press, 1993), 105.

city was besieged by Austrian and Dutch troops and the French hoped to gain a tactical advantage by using balloons to locate enemy positions. After establishing his equipment and operating location, on 2 June 1794, Coutelle conducted the first recorded airborne ISR mission in history.[30] As hoped, from his high elevation, Coutelle was able to provide locations of the Austrian and Dutch armies surrounding the city. In the subsequent days Coutelle conducted numerous sorties and provided unprecedented information about the enemy's locations, artillery emplacements, and working parties.[31] Of particular note is Coutelle's fifth flight. On this sortie, enemy artillerymen aimed their cannons skyward in an attempt to down Coutelle's balloon *L'Entreprenant*. While unsuccessful, these anonymous Dutch or Austrian artillerymen became the world's first anti-aircraft battery.[32]

As Coutelle's efforts were highly successful, over the next several years, the French continued to use the balloon company extensively. In the Battle of Fleurus, Coutelle remained aloft for nearly ten hours and reported extensively on the movements of the Austrian army. Its true effect is unknown, but one French general who accompanied Coutelle on his flight stated that he was able to see the enemy clearly and to distinguish their movement and numbers.[33] In 1797, Napoléon Bonaparte agreed to include a balloon company in his Egyptian expedition. Unfortunately, the balloon and all related equipment were lost at sea during the Battle of the Nile and Coutelle's company was never able to show the future emperor the advantages of balloons. Never a champion for new technology, when Bonaparte returned to France in 1799, he disbanded the balloon corps effectively ending France's

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[30] Haydon, *Aeronautics in the Union and Confederate Armies*, 10.
[31] Peter Mead, *The Eye in the Air: History of Air Observation and Reconnaissance for the Army, 1785-1945*, (London, UK: Her Majesty's Stationery Office, 1983), 14.
[32] Ege, *Balloons and Airships*, 107.
[33] Mead, *The Eye in the Air*, 14.

potential dominance in aviation.[34]

Remarkably, despite their proven value to ground commanders, the use of balloons did not proliferate as widely as would be expected. Napoléon's reliance on his cavalry for reconnaissance and other leaders' attempts to emulate Napoléon's methodology is one likely reason. Another is that early airmen – like many of their successors – perhaps oversold the value of the balloon. As enthusiastic as Douhet or Mitchell, Coutelle perhaps could be called the world's first airpower zealot. In his desire to show the benefits of his device, Coutelle was known to forget he was at war. On one occasion, he even stopped his reconnaissance to demonstrate the balloon and the handling of it to enemy Austrian officers.[35]

Following the Napoléonic Wars, the use of military balloons was sporadic at best. The lengthy period of peace between the great powers resulting from the 1815 Congress of Vienna is the most likely reason. Nations were simply exhausted from war and were not aggressively developing new technologies. Balloons were used more for sport than as artifacts of war. While bombing and information warfare were explored in greater depth, reconnaissance, artillery spotting, and signaling remained the balloon's primary utility.

While balloon development was extremely sluggish during the 1800s, there were two notable advances that contributed to its effectiveness as an ISR platform. Interestingly, both occurred in the United States, a nation that had virtually ignored balloon aviation for the first half of the 19th century. The first advance was the introduction of aerial photography. On 13 October 1860, Boston photographer J.W. Black – aloft in a balloon piloted by Samuel A. King – took the first ever

[34] Ege, *Balloons and Airships*, 107.
[35] Ibid.

successful photographs from an air platform.[36] While extremely rudimentary in nature, these photographs proved the concept of aerial photography and expanded thought regarding the missions of the balloon. With aerial photography, military thinkers began to regard the balloon as more than just a tactical asset. If balloons were able to penetrate behind enemy lines, their photographs would be of more strategic value. Black's success fueled the demand to resolve the navigability problems of balloon flights and led directly to the creation of the dirigible and, tangentially, to the airplane.

The second major improvement to the balloon's ISR capability was the introduction of the aerial telegraph. Flag signaling from a balloon was a consistent problem for the early balloonists. As they went higher in altitude, the ability to see their flags from the ground was hampered by both the great distance and by the wind. Often, balloon observers would not be able to communicate the intelligence gained until after the sortie. Placing a wired telegraph on the balloon was an instantaneous improvement to this process and helped solidify the balloon – and airborne ISR – as a viable means of conducting reconnaissance.

On 16 June 1861, Thaddeus S.C. Lowe, the father of American manned airborne ISR, conducted a flight demonstration in Washington, D.C. The purpose of the demonstration was to show President Abraham Lincoln the utility of balloon aviation and to convince Lincoln to incorporate balloons into the Union Army.[37] On this sortie, Lowe brought a wired telegraph, and at the altitude of 500 feet he dictated the first message ever sent by electric telegraph from the air.[38] In his message – sent to the President – Lowe told Lincoln that he was able to see an area of nearly 50 miles and that he was able to observe all the

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[36] John A. Tennant, ed., *The Photo-Miniature: A Monthly Magazine of Photographic Information, April 1903-March 1904,* vol. V (Harrisburg, PA: Mount Pleasant Press, 1904), 154.
[37] Haydon, *Aeronautics in the Union and Confederate Armies*, 172.
[38] Ibid., 175.

surrounding Union encampments.[39] Lincoln was pleased with the results and ordered the further examination of the balloon's utility as an Army observation platform. With the introduction of the aerial telegraph – though still wired to the ground and not wireless – the enduring problem of rapidly communicating intelligence was mitigated. As the telegrapher on the ground could tap into the existing land-wired telegraph network, intelligence from the balloon could thus be communicated in near real-time to anyone capable of receiving a telegraph. The advantages over the previous systems of flag signaling or weighted message dropping were obvious and greatly increased the expectations of the value of balloon intelligence.

While balloons were used by both sides during the American Civil war, unfortunately, the balloon proved to be more trouble than it was worth. As the ability to actually fly the balloon, that is to control its location, had not been perfected, the balloon remained tethered to the ground. As artillery effectiveness increased, flying a balloon over one's encampment was often more a liability than a benefit. Additionally, despite the advantage the altitude provided for aerial reconnaissance, balloons' limited mobility prevented true in-depth examinations of an enemy's situation. For these reasons, balloons never contributed to battlefield success as had been hoped. The ability to see the enemy positions and communicate that intelligence was, however, a requirement that armies greatly needed. As the century drew to a close, air-minded inventors sought a way to fly without the restrictions – and vulnerabilities – of balloon flight. On a winter day in December 1903, the dreams of early air pioneers came true. With the advent of powered flight, the Wright Brothers ushered in the next era of manned airborne ISR – the airplane.

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[39] Thaddeus S.C. Lowe to President Abraham Lincoln, telegram, 16 June 1861, *The Abraham Lincoln Papers*, Library of Congress, online, http://memory.loc.gov/mss/mal/mal1/103/1031300/001.jpg (accessed 19 January 2012).

Chapter 2

Balloons and Aircraft Mature for War

Once the command of the air is obtained by one of the contended armies, the war must become a conflict between a seeing host and one that is blind.

H.G. Wells

The experience of the French Revolution and the American Civil War fully demonstrated the value of the intelligence gained from balloon reconnaissance. The advent of the telegraph and the development of aerial photography made the development of an airborne reconnaissance capability even more imperative. Yet, the lighter-than-air balloon's lack of mobility, combined with the ineffective method of delivering the intelligence it gleaned, severely hamstrung its effectiveness as an ISR platform. The balloon's shortcomings were so great that General Napoléon Bonaparte and General Ulysses S. Grant disbanded the balloon corps in their respective armies.[1] These limitations drove air-minded inventors to seek improvements to the captive balloon design. These pursuits generally took two directions: designers either sought to modify the balloon or attempted to create heavier-than-air aircraft. Through a comprehensive examination of the evolution of balloon design and the introduction of the airplane, this chapter will complete the analysis of early manned airborne ISR platforms and will set the stage for an evaluation of their use during World War One.

While captive balloons certainly had limitations, the value of the information gained from their reconnaissance missions was simply too great for militaries to discount. Rather than abandon the balloon due to its limitations, inventors sought ways by which they could both propel

[1] Spencer C. Tucker, *The Civil War Naval Encyclopedia* (Santa Barbara, CA: ABC-CLIO, 2011), 47.

and steer the balloon as it floated through the air. In 1784, less than a year after the first Montgolfier flight, Abbé Miolan created a balloon that had four portholes with shutters around each.[2] Miolan designed the portholes to allow hot air to escape during flight, thus propelling the balloon forward. Miolan also devised a mechanism by which he could steer the balloon as it propelled forward. The balloon, 70 feet in diameter, was unfortunately never tested as a fire destroyed it on the day of its maiden flight.[3]

Miolan's design – though not operationally tested – motivated other inventors to design navigable, or "dirigible," balloons. A wide variety of manually operated propellers, fans, enormous wings with hand-operated oars for "rowing" the balloon, sails and rudders, aerial paddle wheels, and many other similar devices were attempted in the pursuit to control a balloon's flight. All of these inventions were failures with some not even leaving the design floor. The shape of the balloon and the lack of power was more than these early inventors could overcome. A radical redesign of the shape of the balloon was the answer that propelled balloon design into the 19th century.

In 1784, a French mathematician and engineer, Jean-Baptiste Marie Meusnier, having witnessed the Montgolfier balloon flights, realized that to be steerable – and thus to be positioned in areas advantageous to the army – a balloon needed to be elongated similar to a sea-going vessel.[4] Meusnier also recognized that to be truly navigable, the balloon would need to be powered in some type of horizontal, vice vertical, fashion. The power for Meusnier's balloon came from three propellers rigged to hand cranks that 80 men would hypothetically turn

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[2] Charles H. Gibbs-Smith, *The Aeroplane: An Historical Survey* (London, UK: Her Majesty's Stationary Office, 1960), 89.
[3] Ibid.
[4] Alvin M. Josephy, Jr., ed., *The American Heritage: History of Flight* (New York, NY: American Heritage Publishing Co., 1962), 41.

from a carriage suspended under the balloon.[5] Unfortunately, Meusnier, who was also a General in the French Army, perished in the wars with Prussia following the French Revolution and never built his envisioned craft.[6] His ideas, however, inspired others. His concept of streamlining the balloon ushered in the dirigible airship – a platform that would bridge the gap between the balloon and the airplane.

In 1850, building on Meusnier's vision, French clockmaker Pierre Jullien built and demonstrated a cylindrical model airship with two airscrews driven by a clockwork mechanism.[7] Jullien's model piqued the interest of French engineer and inventor Henri Giffard. Giffard improved the aerodynamics of the Jullien model and, perhaps more importantly, installed a small steam engine in the balloon's basket to provide power.[8] On 24 September 1852, Giffard conducted the first flight of his airship thereby flying the first aircraft both operating under its own power and steered by a pilot.[9] While Giffard's airship was technically dirigible – demonstrated by the circles Giffard made in the sky with the balloon – the craft only attained a speed of six miles per hour in almost completely wind-free air.[10] If future dirigibles were to be truly navigable, more power would have to be added to ensure the lightweight craft could counteract any winds. Giffard attempted to improve his design, but was unsuccessful and it was not until the late 19th century that dirigible design truly advanced.[11]

Following Giffard's flight, inventors primarily sought engines that could produce sufficient power to drive the airship forward despite any

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[5] Douglas H. Robinson, Giants in the Sky (Seattle, WA: University of Washington Press, 1973), 2.
[6] Ibid.
[7] Basil Collier, A History of Air Power, (Oxford, England: Macmillan Publishing Co., 1974), 8.
[8] Alfred Hildebrandt, *Airships Past and Present*, trans. W.H. Story (London, UK: Archibald Constable and Co. Ltd., 1908), 48.
[9] Lennart Ege, Balloons and Airships, (New York, NY: Macmillan Publishing Co. Inc., 1974), 112-113.
[10] Collier, *A History of Air Power*, 10.
[11] Ege, *Balloons and Airships*, 113.

prevailing winds. In 1872, Henri Dupuy de Lôme – clearly unaware of Meusnier's design – constructed a navigable airship powered by a single large propeller driven by eight people turning hand cranks.[12] In October of 1883, the Tissandier brothers, Gaston and Arthur, flew an airship powered by electricity.[13] These ideas suffered the same fate as that of Giffard; the power sources simply could not provide enough horsepower to consistently propel the airship in difficult winds. The following year, however, two officers of the French Engineering Corps devised an airship that would forever alter the course of the dirigible.

Captains Charles Renard and Arthur Krebs radically modified previous airships designs creating a streamlined, symmetrical look with sophisticated methods of dispersing the hydrogen for lift.[14] The motor was once again electric, but the improved design of the airship resulted in vastly improved power efficiency. On 9 August 1884, Renard and Krebs conducted the first trial flight of their airship, known as *La France*. *La France* was an immediate success. Renard and Krebs found that they were able to navigate their airship and ultimately returned to the same spot from which they had launched.[15] This 23-minute flight marked the first "round trip" sortie in airpower history[16] and, while power was still a limiting factor, showed that militaries would potentially be able to place future ISR aircraft in advantageous positions.

After nearly 100 years of balloon and airship flight, however, major drawbacks still restricted the lighter-than-air craft. First, up to this point, all airships were of either a non-rigid or a semi-rigid type.[17] Armies recognized that for the airship to be a viable reconnaissance

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[12] Peter W. Brooks, *Zeppelin: Rigid Airships, 1893-1940* (Washington, DC: Smithsonian Institution, 1992), 19.
[13] William Earl Johns, *Some Milestones in Aviation* (London, UK: John Hamilton Ltd., 1935), 57.
[14] Robinson, *Giants in the Sky*, 2.
[15] Ege, *Balloons and Airships*, 126.
[16] Johns, *Some Milestones in Aviation*, 57.
[17] Ege, *Airships and Balloons*, 129.

weapon, it would need to be much more durable than the then-current designs. While air-to-air tactics had not been envisaged, threats from the ground were of enough significance to warrant serious concerns about the flimsy design of non-rigid and semi-rigid balloons. Additionally, if armies were to use airships for reconnaissance purposes, inventors would have to solve the power problem. As mentioned, previous design attempts had greatly improved the aerodynamic principles of the airship, but a sufficient power source had yet to be discovered. Airships remained slaves to the winds and could not be considered completely dirigible; early airmen simply could not yet fly where they wanted thus making them almost useless for ISR purposes. With increased mechanization occurring in ground forces worldwide, airborne ISR platforms had to be mobile. Fortunately, inventors discovered solutions to these problems as the 19th century waned and the 20th century dawned.

The man to tackle the durability problem of the airship most effectively was the Hungarian David Schwartz. Having conceived his idea of an aluminum-based airship in 1893, Schwartz began to build the world's first rigid airship in 1895.[18] Schwartz' design was revolutionary using both an aluminum skin and lightweight aluminum tubes in the interior. The maiden – and last – flight of his rigid airship was conducted on 3 November 1897 near Berlin.[19] Launched on an extremely windy day, the flight was disastrous. After takeoff, high winds buffeted the airship resulting in its ultimate crash and destruction. While unsuccessful, the venture proved that a metal – and thus more durable – airship was capable of leaving the ground.[20]

While progress was made regarding the durability of airships, the problem with power remained. In 1887, German inventor Gottlieb

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[18] Collier, *A History of Air Power*, 15.
[19] Ege, *Airships and Balloons*, 130.
[20] Ibid.

Daimler began to experiment with a gasoline engine designed to power an airship.[21] In 1888, Daimler and balloon enthusiast Dr. Karl Wölfert began collaborating on an airship that was powered by one of Daimler's gasoline-powered engines. The first Daimler engine was small – producing only two horsepower – but it proved that engines powered by gasoline engines could provide sufficient and sustainable power to navigate an airship.[22] Over the next nine years, Daimler and Wölfert modified and improved the design of both the engine and the airship. Finally, on 12 June 1897, the inventors conducted a public demonstration of their airship and now six horsepower engine.[23] Upon launch, the balloon rose rapidly to over 3,000 feet altitude and almost immediately burst into flame. This experiment – like so many before it – was a disaster, and did little to demonstrate the practicability of a gasoline-powered engine.[24]

To prove the need for the combustible engine, sustained, safe flight was required. Alberto Santos-Dumont, a Brazilian living in Paris, achieved this. Between 1898 and 1902, Santos-Dumont built and successfully flew ten airships all powered by gasoline engines similar to the ones built by Daimler.[25] While his airships were small, ever more capable engines powered them, with a 20 horsepower engine powering his sixth dirigible. Despite the small carrying capacity of his airships, his four years of safe flying demonstrated finally the utility of the lightweight gasoline engine and paved the way for increased airship and engine size.[26]

Building on Santos-Dumont's work, the French engineer Henri Julliot made the next major contribution. In 1902, he built a 187-foot long semi-rigid airship, named *La Jaune,* which was powered by a 40

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[21] Collier, *A History of Air Power*, 14.
[22] Ibid., 14.
[23] Ibid., 15.
[24] Robinson, *Giants in the Sky*, 3.
[25] Ibid., 4.
[26] Ibid., 4.

horsepower engine – the largest engine yet attempted to power an airship.[27] Between the early winter of 1902 and summer 1903, Julliot completed over 30 successful flights, on one occasion covering 61 miles at an average speed of 22 miles an hour.[28] His record of safety and aerial achievements finally convinced the French government of the value of airpower; Julliot's benefactors – the Lebaudy brothers – donated *La Jaune* to the government and in return received a contract to construct three additional airships for the French army – the first aircraft to be specifically purchased from a non-government entity by any government.[29]

With Julliot's success, the armed forces of most of the leading powers – including the United States – experimented with and eventually adopted airships for naval and military reconnaissance.[30] The last question to be answered was whether the non-rigid, semi-rigid, or large rigid designs would prevail. Julliot had proven the efficacy of his semi-rigid design. The non-rigid balloon still had its proponents, however, and militaries around the world would continue to advocate for and use the non-rigid balloon through the Second World War.[31] The rigid airship, however, had not been proven and Schwartz' failure was the freshest memory in people's minds. German Count Ferdinand Adolf Heinrich von Zeppelin set about to change opinions regarding the rigid airship and to make it the preferred platform for long-range operations.

In his airship design, Zeppelin combined Schwartz' aluminum-based hull and framework with the proven capacity of the Daimler gasoline-powered engine. Additionally, Zeppelin's airships were

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[27] David C. Cooke, *Dirigibles That Made History* (New York, NY: G.P. Putnam's Sons, 1962), 18.
[28] Collier, *A History of Air Power*, 17.
[29] Cooke, *Dirigibles That Made History*, 18.
[30] Collier, *A History of Air Power*, 18.
[31] For further information on US Army Air Corps balloon advocacy, see Otto P. Weyland, "Training Program for Observation Aviation" (study prepared for the Air Corps Tactical School, Maxwell AFB, Alabama), 14 May 1938, 248.262-29, Air Force Historical Research Agency (AFHRA).

enormous as compared to their predecessors; LZ-1 (Luftschiff Zeppelin I) was 420 feet long – nearly three times as long as Julliot's *La Jaune* – and was powered by two 16 horsepower engines.[32] On 2 June 1900, LZ-1 conducted its maiden flight proving the concept of rigidity and combustible engine power. Over the next decade, Zeppelin continued to improve on the design of his airships and continually added engines that were ever more powerful.[33]

With LZ-3, the German government became interested in the rigid airship and Zeppelin – like so many airmen before and after him – oversold its capabilities. In a letter to the Imperial Chancellor dated 1 December 1906, Zeppelin claimed, "…I can demonstrate the possibility of constructing airships with which, for instance, 500 men with full combat equipment can be carried for the greatest distances."[34] Zeppelin's claim was a complete exaggeration. At the time, LZ-3's maximum capacity was only 11 persons.[35] Despite his exaggerations, the German government granted Zeppelin the funding necessary to continue development of his airships.

With each subsequent airship, Zeppelin improved his design providing both additional speed and carrying capacity. The German War Ministry, however, felt Zeppelin was not producing a suitable war machine and in 1909 requested higher altitude and greater speed. For his part, Zeppelin was not interested in the German government's military aspirations. Zeppelin's intransigence caused the War Ministry to look to other designers to inject some competition into the airship business. The brilliant naval architect, Johann Schütte, became Zeppelin's main competitor. Schütte believed Zeppelin's designs were too rigid and made significant improvements to the airframe's flexibility by replacing Zeppelin's unbending design with a more flexible wood-based

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32 Robinson, *Giants in the Sky*, 23.
33 Collier, *A History of Air Power*, 18.
34 Robinson, *Giants in the Sky*, 33.
35 Ibid., 32.

structure.[36] The German government ordered multiple airships from both companies and at the dawn of World War I, had 11 airships ready to conduct both long-range reconnaissance and bombing.[37]

Great Britain watched the German development of the airship closely. With Zeppelin's LZ-4, the British government truly began to worry about the development of German air power. Because of this consternation, the British instituted a crash program to bring its airship capabilities to the same level as the Germans. By 1911, the British had built the *Mayfly*, a 500-foot rigid airship.[38] Though unsuccessful in flight and ironically named, the *Mayfly* proved that despite their lagging behind the Germans, the British could build comparable airships. By the end of the First World War, the British had built no fewer than 226 airships primarily for naval reconnaissance and to counter German mine laying operations.[39]

Airship development in the United States understandably lagged behind the efforts of the European powers. Entrenched with an isolationist attitude and protected by vast oceans, the United States government was simply not interested in developing a strong airship force. Despite the isolationism, there were experimental airships developed. In 1908, the United States Army Signal Corps purchased an airship from Thomas Scott Baldwin and designated it *U.S. Military One*, making it the United States Army's first powered aircraft.[40] This airship was used primarily for experimental purposes, but did help to cement the need for aerial observation. As the war dawned, airship development remained slow in the United States. This hesitancy to develop lighter-than-air flight was caused at least partially by the excitement generated

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[36] Cooke, *Dirigibles That Made History*, 32.
[37] Robinson, *Giants in the Sky*, 68.
[38] Collier, *A History of Air Power*, 21.
[39] Ces Mowthrope, *Battlebags: British Airships of the First World War* (Phoenix Mill, UK: Sutton Publishing Ltd., 1997), xxiii.
[40] Ege, *Balloons and Airships*, 148.

by the Wright Brothers' successful demonstration of heavier-than-air flight in 1903.

Aspiring aviators had long dreamed about heavier-than-air flight. Inventors from Leonardo da Vinci to Octave Chanute hypothesized about aircraft, created elaborate schematics, and even built workable models.[41] Some of these designs effectively solved the heavier-than-air conundrum of aerodynamic lift; with proper winds and power, they were air-worthy. Much like airships, however, the absence of a light and powerful engine constrained these early trials to nothing more than experiments with models and gliders.[42]

Beginning in approximately 1896, manned heavier-than-air flight started to become a reality when American Samuel Pierpont Langley built a 26-pound monoplane powered by a two horsepower engine.[43] On 6 May of that year, Langley catapulted his unpiloted airplane from a boat in the Potomac River. The aircraft attained a speed of 25 miles per hour and flew 3,200 feet before landing safely. Langley, recognizing the significance of his accomplishment presciently stated, "I have brought to a close the portion of the work which seemed to be specially mine – the demonstration of the practicability of mechanical flight – and for the next stage, which is the commercial and practical development of the idea, it is probable that the world may look to others. The world, indeed, will be supine if it do [sic] not realize that a new possibility has come to it, and that the great universal highway overhead is now soon to be opened."[44]

Langley's achievement – the first time in history that a heavier-than-air craft sustained itself in flight for more than a few seconds – and his subsequent successful flight tests helped to convince the United

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[41] Robert M. Kane, *Air Transportation* (Dubuque, IA: Kendall/Hunt Publishing, 2003), 55.
[42] Collier, *A History of Air Power*, 22.
[43] Charles D. Walcott, "Biographical Memoir of Samuel Pierpont Langley," in *Biographical Memoirs*, vol. VIII (Washington, DC: National Academy of Sciences, 1912), 254.
[44] Ibid.

States to further pursue aircraft development.[45] With the outbreak of the Spanish-American War in 1898, a board comprised of Army and Navy officers examined Langley's aircraft and concluded that it had potential for aerial reconnaissance.[46] The United States government gave Langley $50,000 to build a full-size, man-carrying airplane on which he began work almost immediately.[47] By 1901, he had built and successfully tested a one quarter-scale model, but his first full-size airplane was not ready until October 1903.[48] On 7 October, Langley attempted a pre-test of his still unmanned aircraft. He catapulted the aircraft into the air much as he had with his successful 1896 test. Unfortunately, this time his aircraft did not fly and splashed directly into the Potomac River.[49] A subsequent flight on 8 December – this time with Army and Navy officials in attendance – had similar results. As Langley catapulted the aircraft off the ramp, the tail section broke and the aircraft again flopped into the Potomac.[50] With both test flights having been unsuccessful, Langley's efforts marked a dubious beginning for heavier-than-air flight in the United States. The first airplane purchased with public funds was a complete disaster.[51] This failure brought severe rebuke from both the public and the United States Congress, and according to aviation historian Gordon Swanborough, was a primary factor in the Army's delay in recognizing the Wright Brothers' nearly simultaneous success.[52]

In 1899, Wilbur Wright sent a request to the Smithsonian

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[45] Ibid.
[46] Charles H. Hildreth and Bernard C. Nalty, *1001 Questions Answered About Aviation History* (New York, NY: Dodd Mead & Company, 1969), 35.
[47] Gordon Swanborough and Peter M. Bowers, *United States Military Aircraft Since 1909* (Washington, DC: Smithsonian Institution Press, 1963), 1.
[48] Ibid.
[49] Hildreth, *1001 Questions*, 35.
[50] Ibid.
[51] Swanborough, *United States Military Aircraft*, 1.
[52] Ibid.

Institution.[53] Having become interested in aviation, Wilbur and his brother Orville sought information that could help them construct an air-worthy craft. In 1900, working on advice provided by Octave Chanute, the brothers built their first full-size glider.[54] Supposing they were most likely to discover a successful design for a powered aircraft by learning to control gliders, they began a two-year process of building and testing various glider designs before introducing an engine.[55] As with many of their predecessors, however, they quickly learned that all existing engines were too heavy to install in their aircraft.[56] Undeterred, the brothers worked closely with their mechanic, Charles Taylor, and designed and built their own engine and installed it on the aircraft known simply as *Flyer*.[57]

On 17 December 1903, at Kitty Hawk, North Carolina, after several failed test flights, the brothers finally achieved success. At 10:35 in the morning, with Orville at the controls, *Flyer* left the ground and made a flight of approximately 12 seconds, covering 120 feet.[58] The Wrights conducted three additional flights that day, one lasting nearly a minute and covering over 850 feet.[59] These subsequent flights proved that the first success was not a fluke; man had finally achieved heavier-than-air flight. The possibilities were endless. Unfortunately, the spectacular failures of Langley's demonstrations had jaded the United States Army's opinion toward aviation. More than four years passed from the Wright Brothers' successful flight before the Army would again invest in aviation.[60]

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[53] Collier, *A History of Air Power*, 29.
[54] Gibbs-Smith, *The Aeroplane*, 37.
[55] Collier, *A History of Air Power*, 39.
[56] Gibbs-Smith, *The Aeroplane*, 39.
[57] Fred Howard, *Wilbur and Orville: A Biography of the Wright Brothers* (New York, NY: Ballantine Books, Inc., 1908), 106.
[58] Russell Freedman, *The Wright Brothers: How They Invented the Airplane* (New York, NY: Holiday House, 1994), 76.
[59] Gibbs-Smith, *The Aeroplane*, 41.
[60] Swanborough, *United States Military Aircraft*, 1.

While many in the Army did not appreciate the utility of the new flying machine, several did. Primary of them was a young lieutenant named Benjamin (Benny) D. Foulois. Writing at the United States Army Signal School at Fort Leavenworth, Kansas, in December 1907, Foulois made many bold airpower predictions in an essay titled, "The Tactical and Strategical Value of Dirigible Balloons and Aerodynamical Flying Machines." While historians traditionally recognize General Billy Mitchell as the first American airpower zealot, Foulois' words pre-date Mitchell by a decade and are equally as prescient:

> In all future warfare, we can expect to see engagements in the air between hostile aerial fleets. The struggle for supremacy in the air will undoubtedly take place while the opposing armies are maneuvering for position, and possibly days before the opposing cavalry forces have even gained contact. The results of these preliminary engagements between the hostile aerial fleets will have an important effect on the strategical movements of the hostile ground forces before they have actually gained contact.
>
> The successful aerial fleet, or what remains of it, will have no difficulty in watching every movement and disposition of the opposing troops, and unless the opposing troops are vastly superior in numbers, equipment, and morale, the aerial victory should be an important factor in bringing campaigns to a short and decisive end.[61]

Foulois' foresight is impressive. In addition to the above prognostications, he predicted the obsolescence of horse cavalry reconnaissance, stating that a "modern military aeroplane" could more thoroughly reconnoiter the territory in front of an army and "could photograph all of its main features…"[62] His most important contribution, however, is his discussion on wireless communication. As will be seen, quickly communicating intelligence information to the consumer is a continual challenge for airborne ISR forces. Foulois

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[61] Benjamin D. Foulois, "The Tactical and Strategical Value of Dirigible Balloons and Dynamical Flying Machines" (thesis, United States Army Signal Corps School, 1 December 1907), 3, 168.68-14, AFHRA.
[62] Ibid., 5.

tackled the problem at the earliest stages strongly advocating for the continued development of the wireless telegraph.[63] Foulois reckoned that aircraft could not fully realize their potential unless air-to-ground communication was perfected. Additionally, Foulois envisioned the first data stream. In his discussion on the development of wireless communications, he referenced the need to wirelessly transmit aerial photographs, stating, "If this instrument can be relied upon…the aerial fleet of an army will not only be invaluable in securing data of the country over which it passes, but will be able to transmit at once by wireless photographs of the area passed over."[64]

The old adage, "a good deed never goes unpunished" was apparently just as true then as it is today. Upon reading Foulois' paper, the Chief Signal Officer of the United States Army assigned Foulois to the aeronautical board that was conducting airship and airplane trials for the Army.[65] Airship development and the Wright Brothers' success had finally prompted the Army to explore airpower. On 1 August 1907, it had established an Aeronautical Division within the Signal Corps – the first formal military unit concerned with heavier-than-air flying – and ordered it to determine the most suitable aircraft for military purposes.[66] The Aeronautical Division, which of course had no indigenous aircraft production capability, created a public competition. The Division published specifications and opened the bidding to anyone capable of meeting the requirements. After examining 41 bids, these trials reached their crescendo on 2 August 1909 with the Army's acceptance of Wright Model A. Foulois was instrumental in this decision. His experience as an airship pilot had left him underwhelmed by the airship's military

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[63] Benjamin D. Foulois and C.V. Glines, *From the Wright Brothers to the Astronauts*, (New York, NY: McGraw-Hill Book Company, 1960), 45.
[64] Ibid.
[65] Ibid., 49.
[66] Swanborough, *United States Military Aircraft*, 1.

potential.[67] Having witnessed first-hand many of the Wright Brothers' flights and having been a passenger on Orville's final test trial for the Army, Foulois was convinced that heavier-than-air airplanes would provide the Army the best reconnaissance platform.

Following the trials, Foulois continued working to improve aircraft communication capabilities. On 18 January 1910, he and amateur radio enthusiast Frank L. Perry rigged a wireless telegraph to a Wright Model A to prove Foulois' earlier conception of wireless communications.[68] Foulois, from the aircraft, and Perry, from the ground, exchanged messages. Pilots and observers could now communicate in near real time with the ground. Though this story is not well known, this experiment forever changed the future of airborne ISR. As pilots and observers were suddenly able to communicate quickly what they were seeing, the aircraft's value to the Army ground fighter increased exponentially.

The years between 1910 and the United States' entry into World War One in 1917 were characterized by slow, yet steady, progress. In the fiscal year 1912 budget, Congress authorized the Army to buy additional airplanes.[69] Additionally, on 5 March 1913, the Army established the 1st Aero Squadron – with Foulois as its commander – which was to become the first Army air unit to see combat action.[70] By the time of the United States' entry into the war, the Army's aviation section had seven squadrons. Unfortunately, the Army had not provided an adequate number of aircraft for each squadron to become tactically proficient at ISR and artillery spotting. Airmen would hone those skills on-the-job, in combat, primarily on other nations' aircraft.

As this chapter has demonstrated, the ability to control flight was

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[67] Foulois, *From the Wright Brothers to the Astronauts*, 59.
[68] Ibid., 71.
[69] Swanborough, *United States Military Aircraft*, 1.
[70] History, 1st Reconnaissance Squadron, online, AFHRA website, http://www.afhra.af.mil/factsheets/factsheet.asp?id=9710 (accessed 7 February 2012).

the main motivator for aircraft innovation during this period. Many recognized the value of airborne reconnaissance early, but the balloon's limitations severely curtailed armies' ability to integrate fully its capabilities. Additionally, aircraft design lagged behind the implementation of intelligence collection advancements. Test and evaluation characterized aerial development during the 19th century. Dozens of inventors tried hundreds of designs, and most met with abject failure. Those who struck upon design success were usually stymied by power problems. Finally, with Count Zeppelin's rigid dirigible and the Wright Brothers' *Flyer* airplanes, inventors were able to marry their design breakthroughs to engines with significant power to allow control. These successes, combined with Foulois' introduction of the wireless telegraph, set the stage for the next phase of the development of airborne ISR: the aircraft's trial by fire in the First World War.

Chapter 3

Airborne ISR in World War I

Their skill, energy, and perseverance have been beyond praise. They have furnished me with the most complete and accurate information which has been of incalculable value in the conduct of operations.

Sir John French

The aircraft matured rapidly during the early years of the 20th century. Engineers and aviators continually improved the Wright Brothers' design and by 1911, nations began to use airplanes in combat. While the airframes had evolved, their missions remained basically the same. As the First World War dawned, ground commanders viewed aerial reconnaissance and artillery observation as the aircraft's main contribution to land warfare. As the war developed, however, so would the aircraft's capability. Aircraft progress was staggeringly rapid – new aircraft reached the front, only to become quickly outclassed by the next development.[1] During the course of the war airspeeds doubled, maximum altitudes and climb rates tripled, engine horsepower increased fivefold, and armament was added to aircraft.[2] With these capability increases came additional tasks. By the end of the war, the list of missions that aircraft were performing was considerable – strategic bombing, air interdiction, aircraft carrier based attack, air defense, ground attack, and, of course, ISR. Additionally, fighter tactics evolved in World War I that would become standard operating procedure for future generations. Maneuvers such as the Immelmann turn, barrel roll, falling leaf, wingover, and formation flying all became the foundation for

[1] Eric Lawson and Jane Lawson, *The First Air Campaign* (Conshohocken, PA: Combined Books, Inc., 1996), 11.
[2] Ibid.

future fighter pilot training.[3]

Equally impressive was the evolution and employment of ISR capabilities. As the war began, armies were uncertain of the value of the new capability. Communications remained problematic and the veracity of the intelligence gained by observation was still questioned by many skeptical ground commanders.[4] Additionally, many of the airborne observers – as the airborne intelligence officer was first called – exaggerated their reports.[5] In the excitement of their first taste of combat, their poor prior training came to the fore with the observers often misidentifying troop nationalities and activities.[6] As stalemate ensued on the ground, however, airborne ISR became the primary – if not the only – means to gain intelligence about enemy movements. The skills of the observers improved as did their ability to communicate their intelligence. A few major successes removed all doubts as to the importance of the manned airborne ISR asset and laid the foundation for its use in the Second World War and beyond.

Aircraft development in the early 20th century was so rapid that by 1911, several nations were ready to employ the airplane in conflict. Having declared war on the Ottoman Empire on 29 September 1911 as a result of a territorial dispute over the land now known as Libya,[7] Italy was the first nation to use airplanes during war.[8] In 22 October of that year, the Italian aviator Captain Carlo Piazza conducted the world's first manned ISR combat flight when he reconnoitered the Libyan coast searching for Turkish positions. During the nearly yearlong war, the Italians further demonstrated the airplane's potential by conducting

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[3] Ibid.
[4] John H. Morrow, Jr., *The Great War in the Air: Military Aviation from 1909 to 1921* (Washington, DC: Smithsonian Institute Press, 1993), 60.
[5] Lee Kennett, *The First Air War: 1914-1918* (New York, NY: The Free Press, 1991), 30.
[6] Ibid.
[7] Timothy W. Childs, *Italo-Turkish Diplomacy and the War Over Libya, 1911-1912* (Boston, MA: Brill Academic Publishing, 1997), 69.
[8] Basil Collier, *A History of Air Power* (Oxford, England: Macmillan Publishing Co., 1974), 41.

additional tactical reconnaissance, mapping, artillery observation, day and night bombardment, and propaganda leaflet distribution missions.[9]

The second major conflict that saw extensive aircraft involvement was the First Balkan War of 1912-1913. Coming immediately on the heels of the Italo-Turkish War, the Balkan War marked the first encounter in history in which all combatants deployed aircraft operationally.[10] Utilizing a mix of aircraft and balloons, Bulgaria, Greece, Serbia, and Turkey all conducted airborne reconnaissance missions with the Greeks attempting a rudimentary form of aerial bombing.[11] While generally small-scale, the air operations of the First Balkan War helped to solidify the requirement for aircraft in future armies.

European nations were impressed by the Italian aerial achievements in Libya along with the successful air operations in the Balkans. As a result, the majority began immediately developing aviation capabilities. The ever present existential threat felt by most European nations made it imperative for them to maintain conventional balance with their potential adversaries. While still uncertain how to adjust war fighting doctrine to include the airplane and its capabilities, European nations at least understood their potential. This was not the case in the United States.

Following the Army's purchase of the first Wright aircraft in 1909, aviation development in the United States was markedly lethargic. Isolationism characterized the nation's attitude toward foreign conflict. Several Signal Corps officers advocated for an aircraft buildup, but their pleas were generally disregarded. In July 1914, Congress authorized an Aviation Section within the Signal Corps, but the legislation did not include instructions on how the Army was to integrate the aircraft into

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[9] Morrow, *The Great War in the Air*, 25.
[10] Walter J. Boyne, *Air Warfare: An International Encyclopedia* (Santa Barbara, CA: ABC-CLIO, 2002), 66.
[11] Ibid.

the military establishment.[12] A staunchly anti-war Congress and an army full of regular officers with, at least in the mind of airpower pioneer Brigadier General Billy Mitchell, "slow-working minds" combined to severely retard United States aircraft acquisition.[13] Even the Army's Chief Signal Officer, Brigadier General G.P. Scriven, was not convinced of the aircraft's potential. In testimony before Congress in 1914, he recognized the reconnaissance benefits of the airplane, but concluded, "As a fighting machine, the airplane has not justified its existence."[14] While this was undoubtedly true at the time, Scriven's comments serve to highlight the general apathy toward military aviation. The table below shows aviation spending for select European countries and the United States during 1909-1914. The chart perfectly reflects the level of concern in Europe as compared to that of the United States.

Table 1: Aviation Spending 1909-1914

Nation	Aviation Spending
Germany	$28,000,000
France	22,000,000
Russia	12,000,000
Italy	8,000,000
Great Britain	3,000,000
United States	435,000

Source: Arthur Sweetser, The American Air Service; a Record of Its Problems, Its Difficulties, Its Failures, and Its Final Achievements (New York, NY: D. Appleton and Co., 1919), 16.

Though Italy had conducted airborne ISR in Libya and several nations successfully used aircraft during the First Balkan War of 1912,

[12] I.B. Holley Jr., *Ideas and Weapons* (New York, NY: Yale University Press, 1953), 30.
[13] William Mitchell, *Memoirs of World War I* (New York, NY: Random House, Inc., 1928), 11.
[14] Arthur Sweetser, *The American Air Service; a Record of Its Problems, Its Difficulties, Its Failures, and Its Final Achievements* (New York, NY: D. Appleton and Co., 1919), 26.

the true utility of airborne ISR – and the airplane in general – remained unknown as the war began. Most nations had not dedicated sufficient training time to demonstrate, or explore, how the aircraft could help the army on the ground. As with so many other new weapons, the doctrine lagged behind the capability. During the early stages of the war, airmen endeavored to discover both their own potential and to prove the importance of fighting in the air to the skeptics. Fortunately, three early successes would help solidify the role of airborne ISR.

The first major occasion in which aircraft were instrumental to success occurred barely a month into the conflict. Having only recently arrived in France, the British Expeditionary Force (BEF) was assigned to hold the left flank of General Joseph Joffre's French forces near the Belgian city of Mons.[15] This task left British Commander-in-Chief, General Sir John French, in a precarious situation as his position left a gap of some 80 miles between his left flank and the French coast.[16] To give him the flexibility to move his forces to stifle any German attempts to outflank his position, General French ordered the British Royal Flying Corps (RFC) to conduct multiple reconnaissance sorties in the areas surrounding his forces. These sorties identified the German II Corps[17] attempting to do exactly what General French had feared. Additionally, intelligence from these flights informed General French of the French Fifth Army's defeat and withdrawal.[18] He had not received official notification of the defeat, but his air observers were able to ascertain this by observing the retreat of the French forces. With this information, General French stopped his advance and ordered his troops to defend in place. Fortunately for the BEF, the defense was successful and the German advance halted. Had General French not taken these actions,

[15] Lord Ernest William Hamilton, *The First Seven Divisions: Being a Detailed Account of the Fighting from Mons to Ypres* (London, UK: Hurst Publishing, 1920), 14.
[16] Collier, *A History of Air Power*, 49.
[17] Lawson, *The First Air Campaign*, 39.
[18] Morrow, *The Great War in the Air*, 76.

he would have almost certainly been defeated by a much superior advancing German force.[19] Airborne ISR had made its first significant contribution to the ground war. In dispatches sent on 7 September, General French gave glowing tribute to the airmen of the RFC, writing, "I wish particularly to bring to your Lordship's notice the admirable work done by the RFC…Their skill, energy, and perseverance have been beyond all praise. They have furnished me with the most complete and accurate information, which has been of incalculable value in the conduct of the operations."[20] The RFC had made an excellent impression on the ground commanders in the Western Front. On the Eastern Front, German airmen would make a similar contribution.

Germany had long considered Russia to be its most dangerous threat. The Schlieffen Plan – Germany's blueprint for World War I – was predicated on the need to secure a rapid victory over England and France in the West, followed by a consolidation of forces in the East to face the vast potential of the Russian army.[21] Despite Germany's wishes, multi-front combat began early. Barely a month into the war, the Germans were already facing Russian armies in Prussia. By 20 August, the Russian First and Second Army were advancing in the East Prussian region of Tannenberg. Thinking this to be a critical moment in the war, the Germans desperately wanted to stop the Russian advance and planned to destroy the Russian force by shifting all available units to the area.[22] The German Eighth Army commander, General Hermann von François, ordered his air units to conduct reconnaissance of all surrounding areas. Between 20 and 30 August, German air reconnaissance obtained detailed – though sometimes conflicting –

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[19] Collier, *A History of Air Power*, 49.
[20] Peter Mead, *The Eye in the Air* (London, UK: Her Majesty's Stationery Office, 1983), 57.
[21] The Schlieffen Plan had been heavily modified by Helmuth von Moltke, but the fundamental premise remained the same. For further information see, S.L.A. Marshall, *World War I* (New York, NY: American Heritage Press, 1971), 56.
[22] Lawson, *The First Air Campaign*, 39.

information regarding the disposition of the Russian armies.[23] On 30 August, a German ISR flight located the majority of the Russian Second Army marching toward Tannenberg with exposed flanks.[24] These reports – combined with German ground-based signals intelligence collection[25] and intelligence gained from Zeppelin flights[26] – contributed to François' decision to encircle and cut off the main Russian forces. This decision allowed for a complete destruction of the Russian Second Army and bought the Germans the time they needed to solidify their position on both fronts. The victory was one of the most important of the war for the Germans. Following the battle, Field Marshal Paul von Hindenburg lauded the German Air Service stating, "Without the airmen no Tannenberg."[27] With this contribution, both the Germans and British had demonstrated tangible airborne ISR success. The third example – the First Battle of the Marne – would solidify the impact of the reconnaissance aircraft and also highlight the futility of trying to fight without the advantage it provided.

German offensive aggressiveness in the first months of the war had paid off considerably. They had achieved multiple victories in France and Belgium and by the end of August 1914, the overwhelming majority of Allied forces were in retreat toward Paris. Baron Antoine Jomini's dictum that offensive operations are always superior to defensive postures seemed to be bearing out.[28] The Germans had swept aside the paltry Allied defenses and were pursuing the Allies in their retreat. As the German First and Second armies advanced on Paris, their commander, General Alexander von Kluck, believing his forces were

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[23] Dennis E. Showalter, *Tannenberg: Clash of Empires, 1914* (Washington, DC: Potomac Books, 2004), 278.
[24] Lawson, *The First Air Campaign*, 39.
[25] Showalter, *Tannenberg*, 169.
[26] Douglas H. Robinson, *Giants in the Sky: A History of the Rigid Airship* (Seattle, WA: University of Washington Press, 1973), 85.
[27] Quoted in Kennett, *The First Air War*, 31.
[28] Antoine-Henri, Baron de Jomini, *The Art of War* (Mineola, NY: Dover Publications, Inc., 2007), 167.

spread too thin, swung his forces eastward in an attempt to cut Paris off from the main French forces.[29] In a fatal error, the move had exposed Kluck's right flank. Working on information obtained from aerial reconnaissance, Allied commanders immediately planned a counter-attack.[30] Additional ISR reports revealed the exact weak positions in Kluck's formations and enabled two French armies and the BEF to take advantage. German aerial reconnaissance had been so diluted that it was unable to detect the Allied movements.[31] Kluck's forces had no indigenous airborne ISR assets and were left virtually blind to the Allied movements.[32] The subsequent battle resulted in a rout followed by a 40-mile German retreat to the Aisne River where they began fortifying their positions for what would become the infamous trench war stalemate. The first Battle of the Marne changed the course of the war. Airborne ISR provided the intelligence needed to allow Allied commanders to act decisively and save what had appeared to be a likely French defeat and loss of Paris. The German retreat ended all hopes for a quick victory. The Schlieffen Plan was in ruins. Both sides now had to determine how to fight a war for which they had never planned.

In the beginning days of trench warfare, strategic reconnaissance remained the primary role of airborne ISR forces. Observation of rail and roadway traffic was imperative as the need to accurately ascertain the enemy's strength was paramount. While strategic reconnaissance remained important, trench warfare forced doctrinal changes. While the requirement remained to conduct strategic ISR behind enemy lines, the focus of airborne ISR shifted towards the tactical. Primary among these changes was the aircraft's cooperation with artillery units. Long foreseen

[29] Lawson, *The First Air Campaign*, 40.
[30] Collier, *A History of Air Power*, 50.
[31] Lawson, *The First Air Campaign*, 41.
[32] Kennett, *The First Air War*, 32.

by many early airmen – including Benjamin Foulois[33] – artillery spotting became a fundamental part of the ISR forces' mission during the first Battle of the Marne. On 8 September, during the German retreat, a French observation aircraft identified a concentration of German field pieces.[34] By dropping weighted notes to their own artillery, these French airmen directed an artillery attack that destroyed half the artillery of the German XVI Corps.[35] General Joffre was so impressed by the success of the attack that he ordered an immediate change to his airborne ISR units' missions. In his mandate, he greatly reduced the number of reconnaissance flights and dedicated the majority of his sorties to artillery spotting.[36]

Simply allocating additional artillery spotting sorties was not enough. The communications problem highlighted by Foulois in his Signal Corps School essay still plagued air-to-ground cooperation. During the early stages of the war, the primary method for communicating intelligence obtained from ISR sorties was for the pilot to land his aircraft near the artillery battery and simply tell the gunners what he had found.[37] When possible, observers would annotate locations of hostile artillery batteries on maps to aid in their descriptions.[38] To correct fire, airmen would either drop weighted messages from their aircraft or they would release flares, smoke grenades, or empty boxes of white talc into the air.[39] By at least 13 September 1914, however, British ISR aircraft were equipped with wireless telegraphs that allowed them to send instructions via Morse

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33 Benjamin D. Foulois and C.V. Glines, *From the Wright Brothers to the Astronauts*, (New York, NY: McGraw-Hill Book Company, 1960), 45.
34 Kennett, *The First Air War*, 33.
35 Lawson, *The First Air Campaign*, 42.
36 Kennett, *The First Air War*, 33.
37 Ibid.
38 Mead, *The Eye in the Air*, 66.
39 Kennett, *The First Air War*, 33.

code to the artillery batteries.[40] While able to broadcast instructions to the ground, the communication was strictly one way. The excessive noise of the engine and the open cockpit prevented the observer from hearing any Morse transmissions.[41] Additionally, the radio remained prohibitively bulky. To install one of the large wireless devices meant a large sacrifice in fuel and payload. This left the airmen and artillerymen to again pre-coordinate any signaling techniques they required.

In addition to artillery spotting, the need to maintain near real-time battlefield awareness became ever more prevalent during the stalemate. Each side sought to deliver a surprise attack, but under constant aerial surveillance this was next to impossible as each movement was quickly detected by the enemy's array of balloons and airplanes. To keep the enemy's ISR aircraft at bay, each side began to enhance their anti-aircraft guns.[42] The improved capability was successful, but, like almost all battlefield enhancements, was countered by both tactics and technology.

To avoid the anti-aircraft guns, ISR aircraft had to fly at much higher altitudes. This eliminated the threat from the guns, but created an unforeseen dilemma for the observers. At increased altitudes – sometimes as much as 10,000 feet – the observers' ability to discern details was limited. Also, as altitude increased, the observers' field of view would greatly increase; they would see much more than they could possibly document.[43] Additionally, as noted earlier, excited and impassioned observers continued to exaggerate their reports.

To solve all of these problems, airmen turned to aerial photography. The concept having been proved in 1860 by J.W. Black, aerial photography had three main advantages over visual observation. First, the ability to simply take a picture was a monumental leap

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[40] Mead, *The Eye in the Air*, 66.
[41] Kennett, *The First Air War*, 34.
[42] Collier, *A History of Air Power*, 52.
[43] Kennett, *The First Air War*, 37.

forward. In standard observation sorties, airmen often drew pictures of what they were seeing. With aerial photography, observers no longer had to take their eyes off the target to document their findings. Pictures could be taken and analyzed after the mission. Additionally, automatic cameras that would take pictures at preset intervals as the aircraft flew along – much like today's preprogrammed imagery target decks – were developed and used by both the French and Italians.[44] This allowed the observer to focus much more attention on collecting intelligence vice interpreting it.

Second, photographs provided objective data that was untainted by the observer's exaggerations or simple ignorance.[45] The observer took the pictures in the air and separate photographic interpreters analyzed the photographs to determine their intelligence value. Not only did this provide an objective viewpoint, it allowed the photographic interpreters to develop expertise on certain geographic areas. Having viewed the same territory repeatedly, the interpreters were quickly able to detect any changes to the enemy's positions or fortifications.[46]

Third, the quality of the photographs was far greater than any notes or drawings done by the observers. As mentioned, flying was loud, dangerous business. During flight, the observer was expected to locate targets, take notes, draw maps, look for enemy anti-aircraft guns and aircraft, and help the pilot navigate. All of these tasks undoubtedly took away from his ability to draw good images or take good notes. Aerial photographs eliminated this problem. By the end of the war, photography had advanced so significantly that an image taken from 15,000 feet could be blown up to reveal details as small as footprints in the sand.[47]

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[44] Interestingly, the great air theorist, Giulio Douhet, developed the camera used by the French and Italians; Kennett, *The First Air War*, 37.
[45] Collier, *A History of Air Power*, 52.
[46] Ibid.
[47] Kennett, *The First Air War*, 37.

All of these enhancements to aircraft-based ISR served to depreciate the importance of the balloons and dirigibles. Despite the vast pre-war investment, by the end of 1916 both sides had determined balloons and dirigibles to be of limited value as tactical reconnaissance platforms in ground support roles. In the early days of the war, airplanes were used almost exclusively as ISR platforms. As the airplane proliferated, however, both sides used it to deny the adversary the ability to conduct airborne ISR; the airplane became a grave threat to balloons and dirigibles as did improved anti-aircraft guns.[48] Some airplane pilots specialized in attacking balloons and the Germans had even discussed balloon attacks in their pre-war air doctrine *Instructions on the Mission and Utilization of Flying Units Within an Army.*[49] The vulnerabilities of the balloon had led the French to abandon their captive balloon program in 1912 and none of the other early Allies seemed interested in expanding their programs.[50] Upon their entry into the war in 1917, the Americans brought a significant captive balloon contingent – numbering some 446 officers and 6,365 men – but they were used primarily in quiet sectors and did not face the same dangers that the early balloonists did.[51]

While balloon use in support of ground forces continued on all sides throughout the war, it remained an extremely hazardous endeavor. The pre-war belief that the Zeppelin would serve the German Army in tactical and strategic reconnaissance roles was also quickly quashed.[52] The same vulnerabilities that plagued balloons in tactical roles also thwarted German efforts to use them as deep-penetrating strategic ISR

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[48] Douglas H. Robinson, *The Zeppelin in Combat* (Atglen, PA: Schiffer Publishing Ltd., 1994), 374.
[49] James Corum and Richard Muller, *The Luftwaffe's Way of War* (Baltimore, MD: The Nautical & Aviation Publishing Company of America, 1998), 63.
[50] Lennart Ege, *Balloons and Airships* (New York, NY: Macmillan Publishing Co. Inc., 1974), 112-113.
[51] Eileen F. Lebow, *A Grandstand Seat: The American Balloon Service in World War I* (Westport, CT: Praeger Publishers, 1998), 170.
[52] Robinson, *Giants in the Sky*, 84.

assets. With direct battlefield support and long-range strategic reconnaissance eliminated as missions for the Zeppelins, the Germans used them in the two safest roles they could: as naval reconnaissance assets and as strategic bombers.

While the German Army's only practical use of the Zeppelin was for night strategic bombardment, the Navy quickly embraced the Zeppelin as its primary scouting cruiser. As it did not face the same threats as its ground support equivalents, the Zeppelin, flying over open water, was an ideal naval ISR platform and the Germans used it extensively for defensive reconnaissance over the North Sea.[53] Zeppelins detected the movements of enemy surface vessels and submarines and provided the German high command with a fairly accurate picture of the British naval presence in the North Sea. The Zeppelin's significant range, endurance, and mobility, along with its powerful radio equipment, allowed it to prove its value in the Battle of Jutland.[54] While limited by the poor weather leading up to the battle, when used, the Zeppelin kept Chief of the High Seas Fleet, Vice-Admiral Reinhard Scheer informed of the British positions.[55] This allowed Scheer to best orient his naval forces for the battle. Zeppelin success had cemented their position as the leading naval ISR asset in the German navy. Following the battle, Scheer stated, "This tactic [use of Zeppelins] provides the utmost possible security against surprise…therefore airship scouting is fundamental for more extended operations."[56]

German use of the Zeppelin continued throughout the war and debate still rages over the ultimate value of its contribution. Zeppelin historian Douglas Robinson concludes that the Zeppelin was a failure as an ISR asset primarily due to its undependability and the German lack of

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[53] Ibid., 91.
[54] Robinson, *The Zeppelin in Combat*, 164.
[55] Ege, *Balloons and Airships*, 159.
[56] Robinson, *The Zeppelin in Combat*, 169.

doctrine and planning for its use.[57] For the purposes of this study, however, the Zeppelin is valued for the precedents it set. First, the Germans demonstrated the ability to conduct long-range airborne naval reconnaissance accurately – when the weather permitted – identifying enemy vessels and submarines. Second, and most importantly, Zeppelins were able to communicate this information to their chains-of-command in near real time. The inclusion of two-way radios and photographic darkrooms truly set them apart as World War One's most technologically advanced ISR assets and established expectations that all following airborne ISR assets would be expected to meet.

Allied and Central Powers' use of ISR assets continued as described above for the preponderance of the war. The United States' declaration of war against Germany on 6 April 1917 brought considerable excitement to the Allies. At the time, however, the Americans were in no position to contribute to the air war. The Army had established Foulois' 1st Aero Squadron in May 1913, but little progress had been made in acquiring aircraft, establishing doctrine, or training the airmen to conduct ISR missions. Other than an abortive attempt to support General John Pershing's force in the hunt for the Mexican outlaw Pancho Villa, the 1st Aero Squadron had almost no practical experience.[58]

Following the squadron's failure in the Mexican expedition, both Foulois and the head of the Aviation Section, Colonel George Squier, began to heavily advocate for increased funding.[59] As a result of the Mexican fiasco and the airmen's lobbying, in August 1916 Congress appropriated $13,281,666 for aeronautical development.[60] Seven months later – when war was declared – the Army had still made

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[57] Ibid., 375.
[58] Foulois, *From the Wright Brothers to the Astronauts*, 122-137.
[59] Ibid., 138.
[60] C.V. Allen, "History and Development of Observation Aviation" (lecture notes, Air Corps Tactical School, Maxwell AFB, AL, 14 May 1938), 248.262-34, AFHRA.

remarkably little progress. On 6 April 1917, the Aviation Section consisted of 65 officers, 1057 enlisted men, and 55 combat airplanes – 51 of which were obsolete and the remaining four obsolescent.[61]

As it entered the war, the American Air Service desperately required modern aircraft, engines, and flyers. Following the declaration of war, Congress committed an additional $640,000,000 toward building an aviation program, but as the industrial infrastructure and production capacity in the United States was simply not established, the United States Army looked elsewhere to meet its immediate needs.[62] General Pershing – now in charge of the American Expeditionary Force (AEF) – contracted with the French to produce and deliver 5,000 airplanes and 8,500 engines.[63] In addition to foreign aircraft, Pershing decided to conduct the majority of pilot and observer training in-country. To accomplish this, the French agreed to give a large training area near Issoudun to the Americans for pilot finishing training and also agreed to train American observers at the French school in Tours.[64] These two actions, more than anything, allowed the American air service to properly train for combat operations – something they were unable to do in the United States.

The American buildup had finally gained momentum. In addition to the airplane pilots and observers the French were training, the United States' balloon service was in theater and, after a brief spin-up with their French counterparts, prepared to conduct ISR in support of Pershing's forces. Due to their lack of combat experience, Pershing selected the quiet Toul Sector for American entry into the air war. On 26 February 1918, Company B of the 2nd Balloon Squadron, 1st Corps Observation Group, became the first American air unit to enter combat against the

[61] Ibid.
[62] James J. Cooke, *The U.S. Air Service in the Great War, 1917-1919* (Westport, CT: Praeger Publishers, 1996), 17.
[63] Maurer Maurer, ed., *The U.S. Air Service in World War I*, Vol. I (Washington, DC: The Office of Air Force History, 1978), 54.
[64] Cooke, *The U.S. Air Service in the Great War*, 20.

Germans.[65] Pershing tasked the group's commander, Major Lewis Brereton, with the main function of training his group to work closely with the infantry.[66] Because there was no established doctrine, Pershing asked Brereton to experiment and create best practices. Though located in a relatively tranquil section of the front, the Americans had finally entered the fray. Brigadier General Billy Mitchell was on hand to witness the occasion and vowed that airplanes would shortly follow. [67]

In April 1918, Mitchell's prognostication came true. As they had with the balloons, leaders selected the Toul Sector as the most suitable place for the American ISR airplane's combat baptism. Toul was typically free from German aircraft and was viewed as an appropriate location for the American airmen to learn on the job. Additionally, when the group arrived, there were no major combat operations underway and none were foreseen in the future. Brereton – and Mitchell – would be able to experiment with the airplane much as they had the balloon. On 11 April, the group flew its first sortie. On the following day, the group's initial combat occurred when First Lieutenant Arthur J. Coyle of the 1st Aero Squadron was attacked by three enemy planes.[68] After nearly nine years of existence, the Army's Aviation Section had finally entered combat.

For the remainder of the war, America's airborne ISR forces endeavored to develop doctrine and establish themselves as force multipliers. While airmen like Billy Mitchell dreamed of using the aircraft as a quick war-winning instrument, ISR airmen remained focused on fine-tuning their capabilities to support the army. Despite high casualty rates and the continued hesitancy of many ground commanders to accept the intelligence they were providing, much was

[65] Lebow, *A Grandstand Seat*, 64.
[66] Cooke, *The U.S. Air Service in the Great War*, 61.
[67] Mitchell, *Memoirs of World War I*, 183.
[68] Sam Hager Frank, "American Air Service Observation in World War I" (PhD diss., University of Florida, 1961), 223.

done to establish airborne ISR as a necessary component of future air forces.

First, ground commanders became increasingly reliant on the imagery supplied by airborne ISR. As the quality of aerial photography continued to improve, the high quality details it provided were irreplaceable. Ranging from the front lines to deep inside enemy territory, ground assault planners could see every detail of the terrain. Trenches, routes of approach, gun emplacements, and even barbed wire were all visible from the airmen's photographs. Additionally, artillery attack preparation was greatly enhanced by the details the photographs provided.[69] Commanders began planning their artillery assaults based almost exclusively on the imagery the airborne ISR assets provided.

This reliance on imagery created an insatiable demand that drove the rapid modernization of aerial photographic technology and photographic interpretation tactics, techniques, and procedures. As enhanced fighter aircraft forced the ISR aircraft ever higher, camera companies improved their cameras and film to ensure the resolution of the imagery remained at a usable level.[70] The high altitudes also forced aircraft engineers to develop elaborate ways to pump heated air into the aircraft to ensure the cameras did not freeze.[71]

The dependence on imagery and the improved technology also resulted in a major increase in camera-equipped ISR aircraft. In a September 1918 memo to his assistant chief supply officer, Brigadier General Foulois reminded him that as many observation aircraft as possible should be outfitted with cameras and radios.[72] While the Air Service was never able to achieve Foulois' full desires, the emphasis on imagery highlighted the ground commanders' growing trust of the new

[69] Ibid., 60.
[70] Robert S. Ehlers, Jr., *Targeting the Third Reich: Air Intelligence and the Allied Bombing Campaigns* (Lawrence, KS: The University Press of Kansas, 2009), 22.
[71] Ibid.
[72] Brig Gen Foulois, Chief of Air Service, American Expeditionary Force, to Assistant Chief of Supply, memorandum, 13 September 1918, 167.403-183, AFHRA.

technology and the fledging Air Intelligence Section's desire to prove its worth. Intelligence officers implemented crash photographic interpretation training and ensured imagery intelligence – when available – was fused into all of their reporting.[73] By the later stages of the war, planners were using multiple source intelligence reports in all stages of the planning process.

The second major advance in solidifying airborne ISR as a key component of the army's inventory was the provision of intelligence professionals to the operations squadrons and planning staffs. As the role of imagery increased, it quickly became obvious that intelligence officers and photographic interpreters needed to be at the squadron level to ensure the most effective use of the imagery. Following the British model – who had begun assigning intelligence and photographic officers to bomb squadrons early in the war[74] – the Assistant Chief of Staff for Intelligence (G-2) established the requirement for each unit at battalion level and below to have its own intelligence section.[75] At the same time, the G-2 also created an air intelligence organization that placed intelligence officers at bomb and observation squadrons.[76] These officers were tasked with overseeing the interpretation of aerial photography and with rapidly disseminating the intelligence to planners, aircrews, and other intelligence officers up and down the echelon. By the end of the war, these procedures ensured not only a place for the airborne intelligence, but one for the intelligence officer and photographic interpreter.

The third area in which airborne ISR made a significant contribution to the war was in bomb damage assessment (BDA). Artillery

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[73] Ehlers, *Targeting the Third Reich*, 18.
[74] Ibid., 25.
[75] "Report of the Assistant Chief of Staff, G-2, American Expeditionary Force, 15 June 1919," in *United States Army in the World War, 1917-1919, Reports of the Commander-in-Chief, AEF, Staff Sections and Services,* vol. 13 (Washington, DC: United States Army Center of Military History, 1991), 2.
[76] Ehlers, *Targeting the Third Reich*, 26.

attack precision and the target selection process had been greatly improved by aerial observation. Aerial photography of the battlefield provided highly detailed maps of enemy positions and was the basis for artillery attack planning.[77] Airborne artillery spotting had made artillery much more precise and much less a guessing game. As they began conducting strategic bombing attacks far behind enemy lines, commanders wanted the same precision. By November 1917, the British had begun placing cameras on one bomber per squadron[78] and in Foulois' previously mentioned memo, he required his Assistant Chief of Supply to equip at least five percent of all bombing planes with cameras.[79] These plans were simply not sufficient, however, and ISR aircraft were increasingly included in the bomb squadrons to photograph the results of the bombing. Upon their return, these photographs were developed and used by planners to either re-attack targets or to eliminate them from target lists.

Airborne ISR advanced considerably during the war. Evolving from a truly rudimentary, mostly untested capability to indubitable contributors by the end of the war, ISR airmen had shown their potential. The value of the high ground had always been recognized, but the aircraft extended the high ground to seemingly endless bounds. Through artillery spotting, location of enemy positions, identification of enemy movements, aerial photography, and BDA, airborne ISR became an irreplaceable force multiplier to ground forces. Having established itself in World War One, the value of airborne ISR would not be in question during the years before World War Two. The challenge for interwar ISR airmen would be to ensure the aircraft's collection capabilities kept up with technological advances. As will be seen, this simply did not happen. Post-war euphoria and a vow to never again fight

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[77] Kennett, *The First Air War*, 36.
[78] Ibid., 22.
[79] Brig Gen Foulois, Chief of Air Service, American Expeditionary Force, to Assistant Chief of Supply, memorandum, 13 September 1918, 167.403-183, AFHRA.

a war of such magnitude, prompted an inevitable American retrenchment and subsequent draw down in forces. In this environment, sheer survival was at the forefront of airmen's minds. As the Second World War began, the United States would again find itself completely reliant on its Allies for intelligence support and training.

Chapter 4

World War II – Airborne ISR Comes of Age

The knowledge not only of the enemy's precise strength and disposition, but also how, when, and where he intends to carry out his operations brought a new dimension to the prosecution of war.

British Field Marshal Sir Harold Alexander

Airpower emerged from the crucible of World War I as a worthy addition to the United States Army's traditional capabilities. The National Defense Act of 1920 recognized the success of airpower by establishing the Air Service as an independent branch of the Army coequal with the infantry, artillery, and cavalry[1] and the Air Corps Act of 1926 further solidified the ascendancy of the air domain.[2] In addition, the fledging Air Corps generally avoided the full effects of the immediate post-war drawdown.[3] This respite was short lived, however. Limited budgets and an Army still commanded by parochial ground generals conspired against the Air Corps. Beginning in 1929, the Army's leadership made drastic cuts to aviation in an attempt to modernize the ground forces.[4] This shift in focus left the Air Corps with little money to acquire new aircraft and with few people to advance airpower doctrine into the modern era.

As a new war brewed in Europe, American airborne ISR found itself woefully underprepared. The Air Corps' interwar focus on strategic bombing had left airborne ISR doctrine virtually unchanged since the end of the First World War. In addition to stagnant doctrine, ISR aircraft

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[1] I.B. Holley Jr., *Ideas and Weapons* (New York, NY: Yale University Press, 1953), 149.
[2] Benjamin D. Foulois and C.V. Glines, *From the Wright Brothers to the Astronauts*, (New York, NY: McGraw-Hill Book Company, 1960), 206.
[3] Robert F. Futrell, *Command of Observation Aviation: A Study in Control of Tactical Airpower*, USAF Historical Study 24 (Maxwell AFB, AL: USAF Historical Division, Air University, 1956), 1.
[4] Ibid., 2.

capabilities had not kept up with the rapidly modernizing militaries. Though airmen had vigorously advocated for additional reconnaissance aircraft, when America's part in the war began in 1941 the Air Corps had received few modern airframes.[5] As will be seen, this would force the United States to rely heavily on its Allies for air intelligence support during the early stages of the war. Despite the innovation-stifling environment, airborne ISR was on the precipice of a major evolution. As the war progressed, enhanced aircraft capabilities, along with dogged determination, allowed America's airborne ISR forces to make significant contributions to Allied success. In addition to the imagery intelligence (IMINT) mission they had validated during the First World War, airborne ISR forces in World War Two would create first-rate communications intelligence (COMINT) and electronic intelligence (ELINT) collection capabilities. The rapid development and refinement of these airborne intelligence collection techniques helped win the war and established the tactics, techniques, and procedures that subsequent airborne ISR forces would follow for years to come.

Following the end of the First World War, the United States military conducted a rapid force drawdown. In the first month of demobilization, the Army released approximately 650,000 soldiers and within nine months it had discharged nearly 3.25 million.[6] Desiring a return to the United States' principle of a small standing army, politicians lobbied for further downsizing. On 1 February 1920, Idaho senator William E. Borah stated, "universal military training and conscription in time of peace are the taproots of militarism."[7] Borah's statement reflected the thoughts of many Americans. After the terrible

[5] I.B. Holley, Jr., *Evolution of the Liaison-Type Airplane, 1917-1944*, Army Air Forces Historical Study (Washington, DC: Army Air Forces Historical Office, 1946), 8.
[6] W. Stewart, ed., *American Military History*, vol. 2, *The United States Army in a Global Era, 1917-2003* (Washington, DC: Center of Military History, 2005), 54.
[7] Robert K. Griffith Jr., *Men Wanted for the U.S. Army: America's Experience With an All-Volunteer Army Between the World Wars* (Westport, CT: Greenwood Press, 1982), 20.

losses of World War I, many were eager for a return to the United States' traditional isolationism and the relative peace it brought. While the American public and some politicians desired the Army to quickly return to its pre-war size, Congress tempered its actions preferring a more methodical approach to the drawdown. In addition to creating the Air Service, the National Defense Act of 1920 authorized the Army a total of 17,726 career officers – more than three times the pre-war authorization – and 280,000 enlisted men.[8] Congress' hesitation to eviscerate the Army did not last for long, however. By mid-1921, mounting public pressure forced Congress to further reduce the Army's end strength to 137,000.[9] Cuts continued and by the end of 1924, the Army was only authorized 111,000 – a mere 11,000 more than the Treaty of Versailles allowed a defeated Germany.[10]

In addition to the severe personnel cuts, the Army's budget was also meager. Fiscal austerity forced leaders to make difficult decisions. With severely limited funds, they chose to focus on maintaining personnel strength rather than on acquiring new technology.[11] As the 1920s rolled into the 1930s, ground units were still training with the same equipment they had used during the First World War. In his annual report to Congress in 1934, Chief of Staff of the Army General Douglas MacArthur said of the Army's equipment, "We have on hand some hundreds…of tanks, totally unsuited to the conditions of modern war and of little value against an organized enemy in the field."[12]

As opposed to the regular Army, the Air Corps fared remarkably well in the immediate post-war years. Empowered by the Air Corps Act of 1926, the Air Corps sought to solidify itself as a worthy complement to

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[8] Stewart, *American Military History*, 57.
[9] Ibid., 59.
[10] Donald Smythe, *Pershing, General of the Armies* (Indianapolis, IN: Indiana University Press, 1986), 279.
[11] Stewart, *American Military History*, 59.
[12] Edward T. Imparato, *General MacArthur: Speeches and Reports, 1908-1964* (Paducah, KY: Turner Publishing, 2000), 84.

the Army's other branches. Implausibly, fiscal austerity greatly assisted in this effort. The National Defense Act of 1920 had subordinated the Tank Corps to the Infantry Corps.[13] With this subjugation, the Tank Corps lost its share of the budget and was left at the mercy of the infantry officers. The Air Corps, on the other hand, received its own percentage of the budget and used it to increase its personnel levels. In the years following the war, the Air Corps greatly expanded and by 1926, had established aviation observation units at the division, corps, army, and general headquarters (GHQ) levels.[14]

While observation units had proliferated, obtaining suitable aircraft to conduct airborne ISR remained problematic. Intraservice squabbles plagued the procurement and acquisition process. The War Department tasked the Chief of the Air Corps with aircraft procurement, but the other arms and services within the Army had to approve the specifications of those aircraft.[15] As many regular Army officers still considered the Air Corps as the junior partner in the organization, the approval process was lengthy and often plagued by bureaucratic delays. Though many new observation aircraft were evaluated in the 1930s, including the YO-31A, YO-40, YO-47, YO-49, YO-50, and YO-51, the Curtiss 0-1 and Douglas O-2, which were obsolete 1920s designs, dominated the Air Corps' inventory.

Further complicating the aircraft acquisition problem was the Air Corps' growing focus on strategic bombing and the intelligence dilemma it created. To conduct strategic bombing effectively, air planners required airborne IMINT of the prospective targets. With airborne ISR still doctrinally tied to the ground forces and inherently short-range in nature, the Air Corps was left with no method by which it could obtain the deep-penetrating IMINT that it needed. To rectify the situation, the

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[13] David E. Johnson, *Fast Tanks and Heavy Bombers: Innovation in the U.S. Army, 1917-1945* (Ithaca, NY: Cornell University Press, 1998), 72.
[14] Futrell, *Command of Observation Aviation*, 1.
[15] Ibid., 4.

Air Corps set in motion a series of shrewd doctrinal changes that would ensure it received the airborne IMINT it required.

First, in October 1935, the Air Corps revised the basic observation training regulation to bifurcate observation into long-range and short-range.[16] This doctrinal shift established, for the first time, delineation in mission types for airborne ISR units. Short-range observation was to remain the purview of the ground forces and their main source of battlefield airborne ISR, but long-range observation was to belong solely to the Air Corps for the express purpose of conducting deep airborne IMINT in support of targeting efforts for strategic bombing.[17] To further solidify the demarcation, shortly thereafter, Chief of the Air Corps Major General Benjamin Foulois submitted a requirement to Army GHQ for a long-range observation aircraft.[18]

The requested aircraft was, for the first time, categorized as a "reconnaissance" platform, a move that clearly showed the Air Corps' intent to separate *its* observation from the ground army's.[19] In the final effort to secure long-range reconnaissance, the Air Corps made the decision that the reconnaissance aircraft "could be the same type airplanes with which bombardment units were equipped…"[20] This strategy tied airborne ISR to the strategic bomber's future; a future that, by the mid-1930s, ISR visionaries likely suspected was the future of the entire Air Corps. With the ground army focused on other challenges, it paid scant attention to the furtherance of observation aviation and did not recognize the crafty move the Air Corps had conducted.

While the Air Corps postured itself for the future, Army ground generals continued to covet the Air Corps' freedom from the fiscal

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[16] Holley, *Evolution of the Liaison-Type Airplane*, 19.
[17] Lee Kennett, "The US Army Air Forces and Tactical Air War in the Second World War," in *Conduct of the Air War in the Second World War*, ed. Horst Boog (Oxford, UK: Berg Publishers Limited, 1992), 459-460.
[18] Holley, *Evolution of the Liaison-Type Airplane*, 19.
[19] Futrell, *Command of Observation Aviation*, 4.
[20] Ibid.

austerity that plagued the rest of the military. In November 1929, with major backing from influential Army generals, the War Department greatly reduced the army and corps level aviation units and in the early 1930s, also cut the division aviation unit to one air officer and a small enlisted staff.[21] Despite the cuts, Air Corps planners labored to create the most effective force structure possible to support the Army. Unfortunately, most of their planning was nothing more than hypothesis as they had neither the aircraft nor personnel to test their construct. As a result, operational exercises were rare and the observation arm of the Air Corps was unready to support the Army when the Japanese brought war to the United States in December 1941.

Across the ocean, the British and the Germans faced the interwar period much differently. Desperately trying to cling to their empire, the British chose to rely on the dissuasive effect of the potential for industrial mobilization along with building a strong naval and air defense.[22] Choosing to defend the homeland left little room for large-scale development of airborne ISR assets as they played little part in the British defensive strategy. Thus, in the early stages of the war, the British conducted IMINT operations using modified Bristol Blenheim and Westland Lysander observation airplanes.[23] They quickly realized, however, that modern fighter planes would decimate the slow, lumbering aircraft. With this realization, the British began to pursue high-altitude, high-speed IMINT aircraft and by 1941 were using both Spitfires[24] and Mosquitos to conduct the preponderance of their airborne IMINT.[25]

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[21]Major General E.L. King, Assistant Chief of Staff for Operations, to General Douglas MacArthur, Chief of Staff of the Army, memorandum, 29 January 1934, 145.93-69, AFHRA.
[22] Barry R. Posen, *The Sources of Military Doctrine: France, Britain, and Germany Between the World Wars* (Ithaca, NY: Cornell University Press, 1984), 141.
[23] Alfred Price, *The Spitfire Story* (London, UK: Arms and Armour Press, 1995), 93.
[24] Ibid.
[25] Martin Bowman, *Mosquito Photo-Reconnaissance Units of World War Two* (Oxford, UK: Osprey Publishing, 1999), 7.

In Germany, the restrictions imposed by the Treaty of Versailles severely handcuffed German military aircraft development during the 1920s. Forbidden from maintaining an air force, the Germans instead developed a state-of-the-art civilian aviation industry.[26] This allowed them to overtly manufacture aircraft within the mandate of the Versailles Treaty and positioned them well for the rearmament period following Hitler's 1935 establishment of the *Luftwaffe*. Additionally, Colonel General Hans von Seeckt, Commander-in-Chief of the German Army from 1920-1926, recognized the importance of the aircraft and lobbied for the independence of the air arm.[27] Von Seeckt also created a shadow *Luftwaffe* within the German High Command which he made a high funding priority.[28] These efforts – along with secret aircraft training and testing in Russia – simplified the process of creating a war-ready air organization under the Nazis.[29]

From the outset of rearmament and throughout the war, airborne IMINT was an important priority for the Germans. Early rearmament aircraft, Henschel Hs 126, Heinkel He 45, and He 46, were custom built for reconnaissance.[30] As had the Americans, the Germans delineated between long-range and short-range reconnaissance with the He 45 designated for short-range and the He 46 for long-range. In guidance given to reconnaissance units prior to Operation Barbarossa, the *VIII Fliegerkorps* ordered that short-range reconnaissance groups were to be allocated to army commands and that long-range reconnaissance groups

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[26] Williamson Murray, *Strategy for Defeat: The Luftwaffe, 1939-1945* (Maxwell AFB, AL: Air University Press, 1983), 18.
[27] James S. Corum, *The Luftwaffe: Creating the Operational Air War, 1918-1940* (Lawrence, KS: University Press of Kansas, 1997), 52.
[28] Ibid.
[29] For details on German aircraft training in Russia, see Corum, *The Luftwaffe*, 115-118.
[30] Ibid., 162.

would receive their orders directly from the *VIII Fliegerkorps*.[31] As the rearmament period turned into war in 1939, German ISR aircraft production continued, but most ISR aircraft were still multi-engine, low-altitude modified bombers. Searching for a more survivable platform, in 1940, Germany began development of the Ju 86P.[32] Through research and experimentation during the 1930s, the Junkers aircraft corporation had demonstrated the ability to build high-altitude bombers and reconnaissance aircraft with pressurized cabins.[33] The Ju 86P was a modified Ju 86 with an expanded wing span and, by 1944 had demonstrated an operating altitude of over 47,000 feet – far higher than any Allied interceptor.[34] As with other leading-edge German aircraft design, however, the Ju 86P fell victim to the Nazis' mismanagement of the entire aircraft production process.[35] Ultimately, the Germans settled on the Focke-Wulf Fw 189 for short-range reconnaissance and the Ju 88 for long-range operations.[36]

As the war began, British fears regarding the use of bombers as ISR platforms were quickly realized. Of 89 Blenheim IMINT missions conducted over Germany in 1939, 16 were shot down and half of the others did not produce suitable imagery as a result of faulty equipment and the evasive actions undertaken by the aircraft to avoid enemy fighters and flak.[37] The Lysander army cooperation plane fared little better, losing 100 aircraft between the French and British.[38] In contrast, a British project headed up by MI6 conducted multiple successful IMINT sorties over Germany using a heavily modified Lockheed 12A aircraft

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31 James S. Corum and Richard R. Muller, *The Luftwaffe's Way of War: German Air Force Doctrine, 1911-1945* (Baltimore, MD: The Nautical & Aviation Publishing Company of America, 1998), 220.
32 Antony L. Kay, *Junkers Aircraft and Engines, 1913-1945* (Annapolis, MD: US Naval Institute Press, 2004), 142.
33 Ibid.
34 Ibid., 143.
35 Murray, *Strategy for Defeat: The Luftwaffe*, 101.
36 Corum, *The Luftwaffe's Way of War*, 220.
37 Ehlers, *Targeting the Third Reich*, 87.
38 Ibid.

flying at an altitude of 22,000 feet.[39] The head of the project, Sandy Cotton, had realized that for airborne ISR to be successful in the era of modern air defense it required high-altitude, high-speed, long-range, and low-observable aircraft.[40] In what could be viewed as the predecessor to the United States' U-2 and SR-71, Cotton painted his aircraft a pale green color, making it nearly invisible from the ground, and installed three fully automated cameras in the nose.[41] The cameras photographed horizontally and vertically allowing Cotton to image a strip of ground 11 miles wide and dozens of miles long.[42] His flights proved to the Air Ministry that conducting deep-range reconnaissance with the Blenheims was folly. Within three months of his last flight, the Royal Air Force (RAF) adopted modified Spitfires and Mosquitos as their primary IMINT platforms.[43]

While the British and Germans learned the first bitter lessons of modern aerial combat, American military intelligence slumbered. A few officers, including Captain Robert Oliver of the Air Corps Tactical School (ACTS) realized the need for enhanced air intelligence to support strategic bombing, but short of Oliver's lectures at ACTS, precious little had been done within the Air Corps' Intelligence Division to prepare the service for war.[44] It would be well into 1940 before any substantial effort was made to solidify intelligence within the Air Corps. In November of that year, Chief of the Air Corps General Henry Arnold established the Intelligence Division under the Office of the Chief of Air Corps.[45] The creation of the

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[39] F.H. Hinsley, *British Intelligence in the Second World War*, abridged version (Cambridge, UK: Cambridge University Press, 1993), 12.
[40] Ibid.
[41] Ehlers, *Targeting the Third Reich*, 74-75.
[42] Ibid.
[43] Ibid.
[44] Robert C. Oliver, "Military Intelligence MI-1-C" (lecture, ACTS, Maxwell AFB, AL, 3 April 1939), 248.5008-1, AFHRA.
[45] Thomas A. Fabyanic and Robert F. Futrell, "Early Intelligence Organization in the Army Air Corps," in *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, ed. John F. Kries (Washington, DC: Air Force History and Museums Program, 1996), 41.

Intelligence Division allowed Arnold to greatly expand the number of intelligence officers in the Air Corps and also gave him the ability to hire civilian experts. This allowed the Air Corps to grow its intelligence knowledge base and permitted productive discussions about what role intelligence support to air operations should play.[46] The change, however, prompted little real action. Intelligence leadership debated concepts and created a theoretical architecture that would allow them to provide support to both the ground army and the Air Corps, but without additional funding – which remained scarce at this stage – their plans remained just that.

Until 20 June 1941 and the creation of the United States Army Air Forces (USAAF), the Air Corps Intelligence Division remained subordinate to the Army G-2. With independence, the newly established assistant chief of air staff, intelligence (ACAS A-2) sought greater autonomy from the Army. Arnold's first A-2, Brigadier General Martin Scanlon, believed the A-2 should provide the USAAF with all the intelligence necessary to conduct air operations.[47] After having been denied access to intelligence by the War Department General Staff G-2 on several occasions, Scanlon's deputy, Colonel R.C. Candee concluded, "It is apparent that all restrictions which tend to limit the reliability and efficiency of the Air Intelligence Division should be removed."[48] Arnold agreed and directed Scanlon to determine the best method by which the USAAF could become a viable intelligence producer. Scanlon faced considerable resistance from the G-2, but ultimately negotiated several agreements that fundamentally allowed the USAAF A-2 to conduct its own intelligence operations.[49]

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[46] Ibid.
[47] Victor H. Cohen, "History of Air Intelligence to 1945" (unfinished and undated manuscript), 45, 203.6, AFHRA.
[48] R.C. Candee, Chief, Intelligence Division, to General Arnold, Chief of the Air Corps, "Intelligence Division, OCAC," 11 July 1941, 203-6, volume V, part 2, document 253, AFHRA.
[49] Fabyanic and Futrell, *Piercing the Fog*, 46.

With freedom from the Army G-2 secured, the USAAF set out to build its air intelligence structure. Earlier in 1941, after prompting from the team building the Air Corps' first air war plan, the A-2 staff realized that it had precious little data on Germany and no reliable method to obtain updated information. As a result, Arnold sent a series of observers to Great Britain to obtain any intelligence the British were willing to share on the German industrial system and to learn anything they could about airborne IMINT operations. The first of these observers was Major Charles P. Cabell. Spending approximately two months in England from February to May 1941, Cabell's observations established the basic airborne IMINT fundamentals that the USAAF would follow throughout the war and beyond.[50] In a theme that would recur throughout the war, British cooperation was without reservation. Cabell remarked that the British had "thrown open" all the doors to their program and their secrets.[51] Fortunately for the USAAF, Cabell took full advantage of his unfettered access. In visits to the Photographic Reconnaissance Unit (PRU), he learned the concept of using high-speed, high-altitude fighter aircraft for reconnaissance purposes. While visiting the Photographic Interpretation Unit (PIU), Cabell began to appreciate the need for well-trained, disciplined photo interpreters. As a result, his after-action report included multiple recommendations for the USAAF: to build a separate organization to oversee IMINT functions, to establish a technical training school to train both photo interpreters and IMINT intelligence officers, and to establish intelligence groups to oversee IMINT

[50] Charles P. Cabell, "Final Report of Military Air Observer to Great Britain," 7 April 1941, 1, 168.7026-2, AFHRA.
[51] Charles P. Cabell, *A Man of Intelligence: Memoirs of War, Peace, and the CIA*, ed. Charles P. Cabell Jr. (Colorado Springs, CO: Impavide Publications, 1997), 22.

operations.[52] Speaking to the great trust General Arnold placed in Cabell, the USAAF incorporated all of Cabell's recommendations.[53]

While Cabell's visit had helped set in motion the creation of a viable USAAF air intelligence structure, it did little to ameliorate the immediate problem of obtaining updated targeting information on Germany. For this mission, Arnold dispatched Major Haywood Hansell. In July 1941, Hansell arrived in Great Britain for the express purpose of bringing home any intelligence that would help the USAAF's strategic bombing planning efforts. As they had for Cabell, the British welcomed Hansell with open arms and granted him near unfettered access to their files on the *Luftwaffe*, German aircraft and engine production, and the German transportation system.[54] In return, Hansell provided the British with intelligence on the German power grid and on German petroleum and synthetic products.[55] At the end of his trip, Hansell brought home nearly a ton of documents to assist the Air War Plans Division (AWPD) with the building of the United States' first strategic bombing war plan.[56]

The third USAAF officer to visit Great Britain was Major D.W. Hutchinson. In October 1941, he traveled to England to verify the information Cabell had obtained and to work closely with the British on details for an American Air Intelligence School.[57] Hutchinson's trip solidified the importance of airborne IMINT. In his after-action report, he stated, "…the British estimate that over 80 percent of their intelligence comes from aerial photographs."[58] While Cabell's report had caused significant discussion and policy creation in the A-2, Hutchinson's visit

[52] Cabell, *Final Report of Military Air Observer*, 2.
[53] Ehlers, *Targeting the Third Reich*, 80. As further testament to his quality, Cabell went on to become the Air Force's first four-star intelligence officer and retired after serving nine years as the Deputy CIA Director.
[54] Haywood S. Hansell, Jr., *The Air Plan That Defeated Hitler* (Atlanta, GA: Higgins-McArthur/Longino & Porter, Inc., 1972), 52.
[55] Ibid.
[56] Ibid.
[57] D.W. Hutchinson, "Central Interpretation Unit Training," 27 October 1941, I-2, 168.7026-2, AFHRA.
[58] Ibid.

prompted action. Almost immediately upon his return – and on Hutchinson's recommendation – the USAAF created its first Air Intelligence School at College Park, Maryland, to train photo interpreters and officers.[59]

In addition to the Air Intelligence School, Hutchinson's recommendations prompted the USAAF to undertake a major effort to develop an aircraft suitable for airborne IMINT. Having failed at earlier attempts to develop an indigenous platform, in mid-1941, the USAAF began to seriously evaluate the success of the British Mosquito—to the extent that the USAAF eventually used the type in its own squadrons.[60] Cabell's recommendations and Hutchinson's opinions solidified the USAAF decision to pursue its own high-altitude, high-speed fighters as reconnaissance aircraft.[61] The achievements of the twin-engine Mosquito prompted the USAAF to look for a twin-engine aircraft to emulate the Mosquito's speed, maneuverability, and high-altitude capability. Fortuitously, the Lockheed P-38 – already in wide production – was such an airplane and could be easily converted to a reconnaissance role. The USAAF quickly began a conversion program for the P-38E model creating a new aircraft designated as the F-4. The F-4 was successful throughout the war and was the only United States airborne ISR platform with a philosophical tie to future IMINT platforms; it was unarmed and depended on its speed and high altitude to keep it safe.[62] The USAAF finally had its IMINT aircraft. Production was rapid and the F-4, along with its follow-on variant the F-5, became the work horse for airborne IMINT. Other platforms were used, including the P-51, B-17, B-25, and B-29, but none rivaled the F-4's capability. Having secured one leg of the

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[59] Ehlers, *Targeting the Third Reich*, 84.
[60] Roy M. Stanley, *World War II Photo Intelligence* (New York, NY: Charles Scribner's Sons, 1981), 83.
[61] Charles P. Cabell, *A Man of Intelligence*, 22.
[62] Ibid.

airborne intelligence collection triad, the USAAF now shifted its focus to the other two, ELINT and COMINT.

As militaries modernized and their operating areas extended, the use of radio to communicate became ever broader. Modern militaries' reliance on signals intelligence (SIGINT) would be both a major force enhancer but also created a vulnerability for the nation who did not properly secure its communications.[63] As an observer during the Battle of Britain, then Colonel Carl Spaatz had learned to appreciate the value of SIGINT from his observations of British practice.[64] Upon his return to the United States, he advocated for the development of a similar USAAF capability. Time was not on the USAAF's side, however, and as its first airmen began arriving in Great Britain in 1942, they brought with them little general intelligence capability and no signals intelligence (SIGINT) collection capacity. In a report discussing SIGINT operations in North Africa, Signal Corps Colonel Harold Hayes stated, "Prior to the arrival of US troops in the British Isles, little was known about the operation of signal intelligence in the field. Signal radio intelligence companies had been activated and trained…but lacking [sic] the ability to perform against enemy combat radio nets, no actual experience in, nor even clear conception of the possibilities of signal intelligence…"[65] For the early part of the war, much like with IMINT, the United States would be forced to rely on the British for both SIGINT support and training.

In early February 1942 when Brigadier General Ira Eaker arrived in Britain to establish American operations, he brought a total of two intelligence officers with him, Major Harris Hull and Captain Carl

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[63] R. A. Ratcliff, *Delusions of Intelligence: Enigma, ULTRA, and the End of Secure Ciphers* (New York, NY: Cambridge University Press, 2006), 215.
[64] David R. Mets, *Master of Airpower: General Carl A. Spaatz* (Novato, CA: Presidio Press, 1988), 110.
[65] Colonel Harold Hayes, *Lessons Learned from the Operation of Signal Intelligence in the North African Theater of Operations*, after-action report, to Assistant Chief of Staff G-2, War Department, Historic Cryptographic Collection, 1, RG 457, Box 949, National Archives and Records Administration (NARA).

Norcross.[66] For over a month Hull and Norcross were the only members of what would become the VIII Bomber Command intelligence staff. Despite their lack of resources, the two set out diligently to establish a working relationship with the British. As the two nations had previously agreed to exchange all military intelligence, the British lived up to their part of the agreement and were extremely forthcoming with both their intelligence information and their technical procedures.[67] Both Hull and Norcross were granted unfettered access to the majority of the British intelligence enterprise.[68] Years later, Norcross commented, "I often think if the RAF had arrived in Alaska to help us out against the Japanese, it would be most unlikely that we would be as generous with our materials and help as the British were with us."[69] Eaker added, "They [the British] turned over to us all of their experience; they kept no secrets. I don't believe there was ever a more thoroughly cooperative effort in warfare than the RAF…and our tiny but growing US air effort…in the years '42 and '43."[70] The nascent relationship was blossoming, but for the USAAF to truly become an equal partner, more had to be done.

Eaker had arrived in England with little guidance regarding bi-national cooperation, but by the time Major General Carl Spaatz arrived in May 1942, Arnold had realized the poor state of the USAAF's organic intelligence services. As a result, Arnold had armed Spaatz with a letter of instruction outlining the need to establish a working relationship with the British.[71] By July 1942, Spaatz had secured an agreement for

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[66] Robert F. Futrell, "US Army Air Force Intelligence," in *Conduct of the Air War in the Second World War*, ed. Horst Boog (Oxford, UK: Berg Publishers Limited, 1992), 459-539.
[67] Hinsley, *British Intelligence in the Second World War*, 115.
[68] The exception to the British sharing was access to the information coming from the breaking of the German Enigma machine. Throughout the war, the British, and Americans once they were read-in, maintained strict need-to-know access to this information.
[69] Quoted in James Parton, *Air Force Spoken Here: General Ira Eaker and the Command of the Air* (Bethesda, MD: Adler & Adler, Publishers, Inc., 1986), 142.
[70] Ibid.
[71] Hansell, *The Air Plan That Defeated Hitler*, 144.

USAAF airmen to train at British SIGINT schools and in August the first five trainees – four officers and one enlisted man – began their training at the basic intelligence school in Cambridge.[72] In September, two additional officers attended Cambridge, two attended the British Air Intelligence course at Newbold Revel, and one was selected to attend the British "Y"[73] School at Bean Manor.[74] With this bi-national training, the foundation was laid for the Americans to initiate their own air intelligence function. Following graduation, most of these British-trained airmen returned to London to set up and establish the USAAF European Theater of Operations United States Army's (ETOUSA) Signal Intelligence Division (SID) while the rest were sent to the British's Government Code and Cipher School (GC&CS) at Bletchley Park.[75] The British training of these first American intelligence professionals cascaded as the war progressed. The British graciously welcomed USAAF airmen into nearly all of their intelligence organizations and by the end of the war, the intelligence function was truly bi-national with British and American collaboration occurring in all theaters of combat.[76] American SIGINT had a foothold; the next step was to translate the capability to airplanes.

The electronic war during the Battle of Britain impelled the war's first operational use of airborne SIGINT aircraft. Beginning in at least 1936, reports began to reach the German high command that the British were building 350-foot-high antenna masts along the southern and eastern shores of Great Britain.[77] The system – designed to provide British Fighter Command with advanced warning of any German air

[72] "History of Signal Intelligence Division (SID) European Theater of Operations United States Army (ETOUSA)," vol. II Technical History, Historic Cryptographic Collection, Section 1, RG 457, Box 968, NARA.
[73] "Y" was the British designator for SIGINT.
[74] "History of SID ETOUSA," 1.
[75] Ibid.
[76] "Instances of Collaboration Between U.S. Army COMINT and Foreign COMINT Units During World War II (in European, Mediterranean, China-Burma, Southwest-Pacific Theaters)," Historic Cryptographic Collection, RG 457, Box 1369, NARA.
[77] William E. Burrows, *By Any Means Necessary* (New York, NY: Farrar, Straus, and Giroux, 2001), 77.

attacks – was completed by the spring of 1939. The Germans were desperate to obtain information concerning the British radar and in May 1939, the *Luftwaffe* Chief of Communications, Major General Wolfgang Martini, outfitted the dirigible *Graf Zeppelin* with an array of radio receivers designed to intercept signals from the British radar.[78] Beginning on 7 May 1939 and followed on 2 August, the Germans conducted sorties with the Zeppelin in an attempt to ascertain the nature of the British air defense system.[79] Due primarily to German radio malfunctions on the first flight and British radar malfunctions on the second, the Germans were unable to collect any valuable information.[80] While the Germans were unsuccessful, the same cannot be said for the British. They monitored the 7 May German flight and were able to use the Zeppelin sortie as an operational test of their air defense system.[81] The electronic war had begun.

During the first stages of the Battle of Britain, Fighter Command had considerable success defending the island against German daylight bombing attacks.[82] The advantage shifted, however, when the Germans switched tactics and began conducting night attacks in September-October 1940.[83] The darkness – along with the typical British cloud and fog – gave the Germans a natural defense from British fighters. More importantly, the Germans began using a radio guidance beam that directed its bombers to their targets. Due to these newfound advantages, German bombers – though less efficient at hitting their targets – operated with virtual impunity.[84] Fighter Command had not developed a capable

[78] Derek Wood and Derek Dempster, *The Narrow Margin* (London, UK: Arrow Books, 1969), 2.
[79] David E. Fisher, *A Race on the Edge of Time: Radar – The Decisive Weapon of World War II* (New York, NY: McGraw-Hill Book Company, 1988), 4-7.
[80] Ibid., 8.
[81] Wood, *The Narrow Margin*, 2.
[82] Richard J. Overy, *The Air War, 1939-1945* (Washington, DC: Potomac Books, Inc., 2005), 34.
[83] Aileen Clayton, *The Enemy is Listening* (New York, NY: Ballantine Books, 1980), 51.
[84] Stephen Bungay, *The Most Dangerous Enemy* (London, UK: Aurum Press, 2001), 270.

night airborne intercept capability at the time and was shooting down fewer German bombers. In a war of attrition that the British simply had to win, something had to be done.

To stop the German use of the homing beam and tip the balance back in their favor, the British had to determine the nature of the beam, its source, and develop a mechanism to deny its use to the Germans. To do this, the British formed the world's first airborne ELINT unit – the Blind Approach Training and Development Unit (BATDU)[85] – and outfitted it with three specially configured Avro Anson aircraft.[86] The mission of the BATDU was to conduct airborne ELINT collection and direction finding (DF) to gather information on the signal and its origin. The unit flew its first sortie on 19 June 1940[87] – history's first airborne ELINT flight flown in combat – and during the third sortie, on 21 June, was successful in collecting the signal and locating its origin.[88] R.V. Jones' Scientific Intelligence Directorate analyzed the collected data and subsequently built a radio jammer that the RAF ultimately used to deny the Germans use of the beam.[89] This incident marked the first battle in the airborne electronic war; a war that would continually challenge both sides' engineers, mathematicians, and airmen and one that would become central to the United States' future manned airborne ISR programs.

The chance capture of a functional Japanese early warning (EW) radar by United States Marines on Guadalcanal in August 1942 emphasized the need to develop a Pacific-based ELINT collection

[85] Martin Streetly, ed., *Airborne Electronic Warfare: History, Techniques, and Tactics* (London, UK: Jane's Publishing Company Limited, 1988), 124.
[86] Ibid. Interestingly, the British did not have a radio receiver capable of collecting the German *Knickebein* signal. As a result, they settled on an American receiver, the Hallicrafters S-27 to outfit the Ansons. For further information see Alfred Price, *The History of US Electronic Warfare* (Westford, MA: The Association of Old Crows, 1984), 12.
[87] R.V. Jones, *Most Secret War* (London, UK: Penguin Books, 1978), 97.
[88] Ibid., 52.
[89] Jones, *Most Secret War*, 104.

capability.[90] Prior to this, the United States had not considered Japanese use of radar as a potential threat. With the British established as the leader in European ELINT collection, the Americans focused their efforts on the Pacific and began building equipment to help defeat Japanese EW radars. At the National Research Lab outside Washington DC, scientists and engineers began a program known as "Cast Mike."[91] Based on analysis of the captured Japanese EW radar, the Cast Mike project built receivers capable of collecting the signal and jammers capable of denying its use to the Japanese. One of these receivers was installed in a B-17E bomber based at Espiritu Santo in the New Hebrides and on 31 October 1942, this aircraft conducted its first sortie.[92] Though no signals were collected, the mission is significant as it marks the United States' first operational airborne ELINT mission.

American experimentation with various types of aircraft continued and on 6 March 1943, a modified B-24D – subsequently named Ferret I – conducted the first successful airborne collection of a Japanese radar.[93] Flying off the coast of the Aleutian Islands near Alaska, over the next several days Ferret I conducted a thorough survey of the Japanese radar order of battle on Kiska, Attu, and Agattu Islands.[94] With Lieutenants Bill Praun and Ed Tietz operating the radio gear, Ferret I collected operating parameters and coverage areas of the radars on Kiska Island.[95] While the information collected was relatively small in scope, the 11th Air Force (AF) commanding general, Major General William Butler, immediately ordered an air strike on the radars.[96] Airborne ELINT had proved its worth in the Pacific. Until Allied forces could get within

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[90] Ibid., 47.
[91] Ibid., 126.
[92] Price, *The History of US Electronic Warfare*, 49.
[93] John T. Farquhar, *A Need to Know: The Role of Air Force Reconnaissance in War Planning, 1945-1953* (Maxwell AFB, AL: Air University Press, 2004), 13.
[94] Price, *The History of US Electronic Warfare*, 53.
[95] Paul Lashmar, *Spy Flights of the Cold War* (Annapolis, MD: Naval Institute Press, 1996), 19.
[96] Ibid., 55.

airborne range of the major Japanese strongholds, however, there was little utility in conducting frequent sorties. Additional sorties by the CAST MIKE-equipped aircraft and by Ferret I revealed no Japanese EW radar presence in the Bougainville and Guadalcanal areas.[97] As 1943 arrived, the USAAF chose to shift the focus of its airborne ELINT collection to the Mediterranean theater.

The success of the CAST MIKE program and Ferret I demonstrated the value of airborne ELINT operations. As a result, the USAAF outfitted three B-17s – designated Ferret III, IV, and V – and sent them to the Mediterranean to support ongoing operations.[98] Ferret III arrived in Algiers on 7 May 1943 and, as was seen with IMINT and SIGINT, its crew immediately began coordinating with their British counterparts from the RAF's 192 Squadron.[99] Based on British advice, the Americans modified the collection equipment on Ferret III to enhance collection.[100] On 17 May, Ferret III conducted its first Mediterranean flight and over the next 16 months – May 1943 to September 1944 – the Mediterranean Ferrets flew 184 sorties and discovered 450 enemy radar sites.[101] From this data, the Allied Operational Research Section built charts and maps showing the best approach routes for both aircraft and invading forces.[102] Amphibious invasion planners subsequently used this information to assist in the planning for operations Husky (Sicily), Avalanche (Salerno), Shingle (Anzio), and Dragoon (South France).[103]

While airborne ELINT's contribution to the North African and Mediterranean theaters was indubitable, it was perhaps most effective in the Allied buildup to Operation Overlord – the invasion of Northwest

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[97] Streetly, *Airborne Electronic Warfare*, 126.
[98] Price, *The History of US Electronic Warfare*, 71.
[99] Ibid., 72. 192 Squadron also flew airborne ELINT missions using modified Wellington bombers.
[100] Ibid.
[101] Farquhar, *A Need to Know*, 15.
[102] Clayton, *The Enemy is Listening*, 262.
[103] Farquhar, *A Need to Know*, 15.

Europe. Airborne ELINT played a major part in the invasion planning by conducting hundreds of collection sorties all along German-occupied territory. By the early spring of 1944, Dr. R.V. Jones' Scientific Intelligence department at the Air Ministry in London had a fairly comprehensive picture of the German radar system.[104] However, many of the German radars were mobile and routine updates were required to maintain exact knowledge of their positions; this task fell to the Ferret aircraft. Ferret sorties ensured the Allies' awareness of German radar use and also contributed to the development of radar jamming devices which were used extensively during the actual invasion.[105] As in the other theaters, airborne ELINT had contributed prominently in Northwest Europe.

Airborne ELINT collection continued in both theaters throughout the war. Ever-improving collection capabilities, combined with refined tactics, techniques, and procedures, produced a remarkably efficient airborne ELINT capability by the end of the war. Airborne ELINT collection was prolific with the British alone flying over 1,400 operational sorties.[106] These sorties resulted in the identification, geo-location, and subsequent destruction of countless enemy radar locations. Postwar estimates vary and gauging a force enhancer's true impact is always difficult. According to one official survey of electronic warfare: "…it can be said that radar countermeasures undoubtedly saved the US forces in England roughly 450 planes and 4,500 casualties…Roughly, the same considerations apply to our Strategic Air Force in Italy whose size was fully half that of its British-based counterpart."[107] Whether these numbers are completely valid or not is irrelevant. What is certain is that the efforts of these early airborne ELINT pioneers unequivocally contributed to Allied success and saved lives.

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[104] Price, *The History of US Electronic Warfare*, 117.
[105] Ibid., 123.
[106] Streetly, *Airborne Electronic Warfare*, 128.
[107] Quoted in Price, *The History of US Electronic Warfare*, 197.

While the Allies were perfecting their airborne ELINT and IMINT capabilities, a similar effort was underway to create an airborne COMINT capability. The idea of placing linguists on aircraft to monitor radio signals traces back to the electronic war in the Mediterranean. In the summer of 1942, during flights to determine the extent of German radar coverage in the Sardinia-Taranto-Tripoli areas, the British began placing linguists on 162 Squadron's Wellington ELINT aircraft.[108] Initially only experimental, the linguists' ability to provide the pilots with advanced warning of German fighter activity became highly valued. As with so many other developments, the Americans adopted the British procedure and by October 1943 were flying with at least one linguist on their Mediterranean ferret aircraft.[109] In addition to protecting the aircraft and bomber formations, the linguists were able to call-in friendly fighters to attack airborne German aircraft. First Lieutenant Roger Ihle, one of the earliest American airborne electronic warfare officers, stated, "We had these German speaking boys we had monitoring all of the aircraft frequencies of the Germans, so when they heard the Germans starting to scramble, why, they told the [American] fighters what was happening…"[110] The airborne position that we now know as "Direct Support Operator" was born. The enhanced situational awareness that airborne linguists provided had been validated.

After the German defeat in North Africa and their subsequent withdrawal north, African-based terrestrial SIGINT collection became increasingly less effective. Ground-based antenna simply did not have the range to keep-up with the German fall-back and, as the Germans continued to retreat into Central Europe, the geography of the Italian Alps further degraded SIGINT reception. To ameliorate the loss of

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108 Clayton, *The Enemy is Listening*, 212.
109 Alexander S. Cochran, Robert C. Erhart, and John F. Kreis, "The Tools of Air Intelligence: ULTRA, MAGIC, Photographic Assessment, and the Y-Service," in *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, ed. John F. Kries (Washington, DC: Air Force History and Museums Program, 1996), 97.
110 Quoted in Burrows, *By Any Means Necessary*, 85-86.

intelligence from the decreased COMINT coverage, intelligence officers at the Mediterranean Allied Strategic Air Force (MASAF) suggested putting linguists on Twelfth and Ninth Air Force heavy bombers.[111] As the idea had been successful with the ferrets and the British 162 Squadron, Allied planners believed it would greatly expand the range of their COMINT collection. MASAF placed a call for volunteers and 50 airmen applied to the program.[112] With the British still maintaining the majority of the SIGINT expertise in theater, MASAF decided that the British would conduct the volunteer screening and initial training. British Sergeant J. Rosenthal was selected for the job and began screening the volunteers.[113] From the initial 50 applicants, Rosenthal selected four for actual training and by 3 October 1943, all four had passed Rosenthal's rigorous training program.[114]

The value-added from airborne COMINT collection was immediate. Using only paper and pencil – no recording or playback ability was installed on the aircraft at the time – the airborne linguist was able to keep the bomber formation informed when enemy fighters were airborne and could even determine the approximate range of the reacting German fighters based on the signal strength of the monitored frequency.[115] As the MASAF Operational Research Section had already determined, the Germans preferred to attack bombers which had become detached from the main bomber formation. Airborne linguists could determine when German fighters were trailing the formation waiting for stragglers and could subsequently warn the aircrews to tighten their formations.[116]

[111] Clayton, *The Enemy is Listening*, 330.
[112] Ibid.
[113] Ibid.
[114] Ibid.
[115] Ibid.
[116] "Report on Airborne Interception of Enemy R/T Traffic Carried Out With the Fifteenth Air Force," report, 2d Lt Jakob Gotthold, Air Communications Office, HQ US Army Air Corps, 6, 1 November 1944, McDermott Library, Clark Special Collections Branch, General George C. McDonald Collection, Collection 16, Series 5, Folder 11, United States Air Force Academy (USAFA).

Additionally, the airborne linguists' post-mission reports were of high strategic value. Not appreciated initially, after intervention from the more experienced British, MASAF intelligence analysts began to use the post-mission logs to determine German order of battle in Central Europe. This knowledge greatly enhanced the Allies' overall understanding of both German operational and strategic intent and was used extensively in invasion planning during the Italian campaign.[117]

In May 1944, recognizing the need to extend its COMINT coverage, the Eighth Air Force began its own efforts to collect airborne COMINT during bomb raids over Germany. At first, it installed only recorders on its bombers with no linguists to monitor the collected traffic in real-time.[118] Judging this method to be ineffectual, the Eighth AF quickly instituted a training program to provide a pool of qualified airborne linguists who could monitor the signals during the sorties and provide threat warning to the aircrews.[119] Again, the British played a large part in this effort. Women's Auxiliary Air Force (WAAF) Section Officer "Rusty" Goff – one of the first WAAF SIGINT officers – was selected to lead the training.[120] After the initial training build-up, the Eighth AF used up to 12 linguists per mission and truly began to value the contribution the linguists were making.[121] In a time of unsecure communications, however, the information obtained by the airborne linguists was only useful to the bomber formation in which the linguist was flying.[122] As all bomber formations adhered to strict radio silence procedures until after "bombs away," nearly all intelligence collected was only available to the

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[117] Ibid., 331.
[118] "Status of "Y" Intelligence in Eight Air Force," report, Eighth Air Force Director of Intelligence, 1, 1 May 1945, Carl Spaatz Papers, Box 297, Library of Congress (LOC).
[119] "The Contribution of the "Y" Service to the Target Germany Campaign of the VIII Air Force," report, Eighth Air Force Director of Intelligence, 4, 18 March 1945, Carl Spaatz Papers, Box 297, LOC.
[120] Clayton, *The Enemy is Listening*, 332.
[121] "Status of "Y" Intelligence in Eight Air Force," 1.
[122] "Outline History of Operational Employment of "Y" Service," report, Maj H. Elsas, A-2, 8th AF HQs, to Maj Leon Benson, A-2, HQ USSTAF, 6 June 1945, 3, Carl Spaatz Papers, Box 297, LOC.

aircraft in which the linguist was flying.[123] As early as 1 November 1944, Technical Sergeant Jakob Gotthold – one of the USAAF's first airborne linguists – made recommendations for the development of an interplane signaling system, but one was never sufficiently established before the end of the war.[124]

Despite the obvious benefits to the crews, airborne COMINT in the European theater was plagued by a lack of airborne recorders and by a shortage of trained personnel well into 1945. In a meeting of the theater A-2s, a lengthy discussion ensued regarding both topics. Colonel James Edmundson highlighted the fact that of 100 Hallicrafters S-27[125] receivers his group had requested, only four had arrived with the other 96 having been given to the Navy.[126] In the same meeting, Colonel Sam Barr added that people were his biggest problem.[127] Gotthold also highlighted these problems in a report to HQs USAAF in November 1944. In his report, Gotthold recommended the use of recorders on all airborne linguist sorties and lobbied for the creation of a comprehensive training program.[128] Brigadier General George C. McDonald, Spaatz' Intelligence Officer, was present at the A-2 meeting and promised to address the persisting airborne COMINT problems with Spaatz.[129]

Even with the problems, airborne COMINT collection was seen as having both significant tactical impact and strategic utility.[130] The meeting of the A-2s mentioned above reiterated the lingering problems, but the overall conclusion was that airborne COMINT was a major contributor and had to be pursued. An Eighth Air Force report sent by

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123 Gotthold, "Report on Airborne Interception of Enemy R/T Traffic," 4.
124 Ibid.
125 The Hallicrafters S-27 was the receiver of choice for the airborne mission. For further information see, Gotthold, "Report on Airborne Interception of Enemy R/T Traffic," 2.
126 Minutes, HQ USSTAF/Directorate Intel, "Meeting of A-2s of American Air Forces in Europe, Held 0900-1800 Hours, Jan 23, 1945," Carl Spaatz Papers, Box 121, LOC.
127 Ibid.
128 Gotthold, "Report on Airborne Interception of Enemy R/T Traffic," 18.
129 "Meeting of A-2s of American Air Forces in Europe," 8.
130 "The Contribution of the "Y" Service," 1.

Major Herbert Elsas to General McDonald concluded that the information derived from airborne COMINT collection was "the only basic source material of signals intelligence originated by Eighth Air Force."[131] As the USAAF was still trying to justify its requirement to have an indigenous intelligence capability, airborne COMINT was seen as a unique source that could not be provided by other means. Additionally, in a report on the effectiveness of airborne COMINT, the 8th AF A-2 stated, "The airborne "Y" project can be considered to have produced highly successful results…"[132] In Europe and the Mediterranean, the USAAF would continue flying airborne COMINT missions until V-E Day. While the impact of their contribution can certainly be debated, the mere fact that they had advanced such a great deal in less than three years must be commended.

While airmen in the ETO were perfecting their airborne COMINT collection capabilities, a similar effort developed in the Pacific Theater. In the early stages of the war, there was little need for an airborne COMINT capability. Ship and ground-based COMINT interception collected strategic and tactical Japanese COMINT and was deemed adequate to meet both the Army's and Navy's needs. The vast distances of the Pacific theater also hindered the development of airborne COMINT. In April 1944, with the B-29 Superfortress' arrival in India, the ability to strike Japan herself was realized as was the ability to collect COMINT during the strikes. The USAAF installed Hallicrafters S-27 receivers in the B-29s[133] of XX Bomber Command's 58th Bombardment Wing and Nisei (Japanese-American) linguists began flying combat sorties in Southeast Asia and Formosa.[134]

Though the Nisei of XX Bomber Command performed exceptionally

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131 Major Herbert Elsas, A-2 Section, 8 AF, to Director of Intel HQ 8 AF, 5 May 1945, Carl Spaatz Papers, Box 297, LOC.
132 "The Contribution of the "Y" Service," 4.
133 Streetly, *Airborne Electronic Warfare*, 127.
134 James C. McNaughton, *Nisei Linguists: Japanese Americans in the Military Service During World War II* (Washington, DC: Department of the Army, 2006), 371.

well – with some even winning Air Medals[135] – at the time, the USAAF did not have a sufficient number of Japanese linguists to extensively prosecute the airborne mission. This all changed on 10 November 1944 with the arrival at Guam of the 8th Radio Squadron Mobile (RSM) and its complement of 50 Japanese-American Nisei linguists.[136] Established as part of USAAF's effort to provide an indigenous intelligence capability, the 8th RSM's mission was to "provide radio intelligence to the Air Force commander and to the theater commander by means of radio intercept, radio direction finding, traffic analysis and evaluation of enemy radio traffic, telegraph, and voice."[137] Upon its arrival in Guam, the 8th RSM was assigned to the Joint Radio Analysis Group, Forward (RAGFOR).[138] At the time, the United States Navy was the lead organization for all intelligence in the Pacific and as the USAAF and Navy had not pre-coordinated the 8th RSM's mission, the Navy simply integrated the 8th RSM into RAGFOR. After many memos between the staffs of Admiral Chester Nimitz, General Arnold, and, ultimately, Army Chief of Staff George Marshall, the 8th RSM was allowed to exclusively support the USAAF.[139]

Beginning in approximately January 1945, Guam-based B-29s equipped with automatic recorders collected Japanese communications during their bombing missions over Japan.[140] Upon landing, personnel from the 8th RSM would extract the tapes and the Nisei linguists would transcribe the intercepted communications to extract any information with strategic intelligence value. As with the information collected in the

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[135] *Pacific Citizen*, vol. 20, no. 25, 23 June 1945, accessed online at http://www.pacificcitizen.org/digitalarchives/assets/pdf/19450623.pdf.
[136] History, "The Story Behind the Flying Eight Ball," 8th Radio Squadron Mobile, 1 November 1942 – 2 September 1945, 25.
[137] "History of SID ETOUSA," section 7.
[138] Larry Tart, *Freedom Through Vigilance: History of the U.S. Air Force Security Service* vol. I (West Conshohocken, PA: Infinity Publishing, 2010), 22.
[139] "OP-20-G-File," Communication Intelligence Organization, Department of Navy memoranda, SRH-279, 180.2043-63, AFHRA.
[140] McNaughton, *Nisei Linguists*, 371.

ETO, the Nisei were able to build a rudimentary Japanese air order of battle and began to learn Japanese air tactics. This method, while of operational and strategic, long-term value, limited the 8th RSM's ability to truly understand Japanese air and air defense tactics. The recorders were rudimentary and typically only allowed one frequency to be recorded during a sortie. This was simply not sufficient to fully develop an understanding of Japanese order of battle and tactics. In the spring of 1945, ten of the 8th RSM's Nisei[141] began flying operational combat missions on B-29s and B-24 Ferret aircraft.[142] Their impact was immediate. In a memorandum from Lieutenant Commander Robert Seaks, RAGFOR officer-in-charge, to the 8th RSM squadron commander, Major William Mundorff, Seaks stated, "Its [voice intercept] potentialities were just being realized…not too much has been known about Jap [sic] use of voice in Air/Ground traffic…Jap voice…was close to a virgin field, and one which the 8th RSM was almost alone endeavoring to exploit."[143] From that spring to the end of the Pacific War in August 1945, the airborne Nisei – along with the rest of the 8th RSM – performed exceptionally well. The squadron received kudos from multiple commanders and – despite the earlier consternation about its rightful mission – even received a commendation letter from Admiral Nimitz himself. In the commendation, Nimitz stated, "Joint operation of the 8th Radio Squadron Mobile and the Navy Supplementary Station in Guam…proved to be a very profitable arrangement…The proficiency developed by the officers and men of the 8th Radio Squadron Mobile in their field of signal intelligence, and hence their share in the victory over

[141] While only ten Nisei participated, according to the 8th RSM history, all 50 volunteered. For further information see *The Story Behind the Flying Eight Ball*, 39.
[142] Kenneth P. Werrell, *Blankets of Fire: U.S. Bombers Over Japan During World World II* (Washington, DC: Smithsonian Institution Press, 1996), 191.
[143] Lt Cdr Robert B. Seaks, Officer in Charge, RAGFOR, to Major William Mundorff, Commander, 8th RSM, "Performance of 8th Radio Squadron Mobile," date not provided, reproduced in *The Story Behind the Flying Eight Ball*, 40.

Japan, can well be a source of pride to them."[144]

In addition to the Nisei of the 8th RSM, there was a similar effort conducted from Clark Air Base in the Philippines.[145] Between April and July 1945, Nisei airmen of the USAAF's 1st RSM flew on at least five B-24 bombing missions over Formosa and Kyushu.[146] While the exact number of Nisei who flew is uncertain, these airmen – like their brethren in the 8th RSM – contributed significantly to the situational awareness of their aircrews. Flying in a modified position in the bomb bay of the aircraft, the airmen listened for any Japanese air or anti-aircraft activity that would help keep the bombers safe. In a reflection of the importance of their contributions, many of the 1st RSM Nisei were awarded Bronze Stars for the contributions.[147]

The end of the war in the Pacific marked the end of airborne ISR's most dramatic period of evolution. From a nascent capability that was truly one-dimensional with airborne IMINT as its only function, airborne ISR had developed exponentially during the war years. By war's end, the United States' development of airborne COMINT, ELINT, and IMINT collection capabilities had set the foundation for all future airborne ISR. In addition to the capabilities, the USAAF had established the need for both strategic and tactical intelligence collection. The USAAF's requirement to obtain imagery to support strategic bombing had bifurcated IMINT into strategic and tactical levels. As World War Two quickly became the Cold War, the need for strategic intelligence – both IMINT and SIGINT – would become increasingly important. Strategic intelligence collection was accepted as a necessary requirement to

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144 Admiral Charles Nimitz, Commander in Chief, U.S. Pacific Fleet and Pacific Ocean Areas, to Commanding General, U.S. Army Strategic Air Forces, "Contributions of the 8th Radio Squadron Mobile to the Joint Army-Navy Radio Analysis Group," date not provided, reproduced in *The Story Behind the Flying Eight Ball*, 40-41.

145 Larry Tart and Robert Keefe, *The Price of Vigilance: Attacks on American Surveillance Flights* (New York, NY: Ballantine Books, 2001), 174.

146 Ibid.

147 Ibid., 175.

support deep-strike targeting efforts while tactical intelligence remained the purview of the USAAF's ground support units. These differences would be fundamental to the USAF's airborne ISR function as it moved forward into the Cold War. The world's shift to a bi-polar structure and the focus on nuclear weapons would determine how airborne ISR forces would develop in the years following World War Two.

Chapter 5

Strategic Airborne ISR – The Cold War

Probe him and learn where his strength is abundant and where deficient.
Sun Tzu

World War II was the keystone event from which all future airborne ISR evolved. During the course of the war, through close liaison with its British ally, the United States developed viable airborne IMINT, COMINT, and ELINT capabilities. While all three competencies were initially conceived to support ground operations, the USAAF's doctrinal focus on long-range, strategic bombing necessitated a concurrent focus on strategic intelligence collection. A major postwar drawdown and the concomitant budget cuts placed the USAAF – and eventually the new United States Air Force (USAF) – in the difficult position of having to place higher emphasis on strategic rather than tactical intelligence.

As the Cold War escalated, it became clear that the Soviet Union (USSR) would be the United States' major adversary for the foreseeable future. While USAF planners began building target information for strategic air warfare, they quickly recognized the great dearth of intelligence on the USSR. If called upon, air force bombers needed to know what the critical Soviet targets were; in the late 1940s, American-derived information simply did not exist.[1] When the Soviets joined the nuclear age in 1949, the need became paramount. This, more than anything, drove the USAF intelligence community to focus almost exclusively on strategic intelligence from the end of World War II through the fall of the USSR. As the Cold War progressed, this emphasis would determine the types of aircraft and intelligence collection personnel the

[1] Early in the Cold War, American and British targeteers relied on captured Luftwaffe target folders and reconnaissance pictures of Russian industrial areas.

USAF would craft. As will be discussed in chapter six, both of these – aircraft and personnel – would limit the USAF's ability to prosecute airborne ISR in a tactical intelligence collection role. To meet the Cold War's intelligence demands, however, the USAF built an extremely modern and competent strategic airborne ISR capability. This force – built primarily in the 1950s and 1960s – would comprise the backbone of USAF airborne ISR throughout the Cold War and into the 21st century.

Before the end of World War II, the terms *strategic aerial reconnaissance* and *tactical aerial reconnaissance* had already entered the USAAF's lexicon. In the intelligence appendix of the USAAF's report on the contributions of airpower to the defeat of Germany, the United States Air Forces in Europe (USAFE) A-2 defined *strategic aerial reconnaissance* as "the program of acquiring aerial intelligence as a basis for carrying on strategic air warfare against the enemy."[2] Further in the report, the A-2 defined *tactical aerial reconnaissance* as being concerned with "large scale daily cover of the enemy forward areas, damage assessment photographs for fighter bomber attacks, and enemy defenses, airfields, and other special targets up to 150 miles from the front."[3] This clear delineation served to further the USAAF's needs for an indigenous airborne collection capability. To provide airborne intelligence beyond 150 miles behind the front required purpose-built aircraft. Additionally, one of the conclusions in the United States Strategic Bombing Survey (USSBS) was that "the U.S. should have an intelligence organization capable of knowing the strategic vulnerabilities, capabilities and intentions of any potential enemy."[4] In a calculated move to ensure USAF airborne ISR autonomy, the service had codified

[2] "The Contribution of Air Power to the Defeat of Germany," appendix M, Miscellaneous Aspects of Air Power, 1, Assistant Chief of Staff, A-2, Headquarters United States Air Forces in Europe, date not annotated, Carl Spaatz Papers, Box 274, Library of Congress (LOC).
[3] Ibid.
[4] John T. Greenwood, "The Atomic Bomb–Early Air Force Thinking and the Strategic Air Force, August 1945–March 1946," *Aerospace Historian* 34, no. 3 (September 1987): 161.

the requirement for long-range strategic intelligence. As the war ended, however, these doctrinal clarifications would be overcome by the rapid drawdown.

While airborne ISR had proved its value, it did not rate high on America's priority list immediately following the war. The secretive nature of World War II airborne ISR operations along with the unparalleled success of the ULTRA and MAGIC codebreaking efforts left many American commanders unconvinced of the usefulness of airborne ISR.[5] While the USAAF retained a bare-bones capability, most airborne ISR faded from memory as postwar euphoria washed over the nation. Additionally, the United States approached the end of World War II as it had following the First World War; a general feeling of relief left many desiring a return to isolationism and peaceful times. Millions of American men needed jobs, and maintaining a large standing military was far from many people's thoughts. Almost immediately following the signing of the surrender document between the United States and Japan on 2 September 1945, America began a precipitous military drawdown.

On V-J Day, the United States armed services comprised over 12 million men.[6] By the end of July 1946, approximately nine million had been released and by July 1947, only 1.6 million were still on active duty.[7] The USAAF – even though it would become the backbone of early Cold War military strategy – was not immune from the cuts. On V-J Day, it had 2,253,000 men in uniform along with 318,514 civilians.[8] Within five months, the military figure had shrunk to 888,769 and by May 1947, only 303,600 military and 110,000 civilians were left in the

[5] ULTRA and MAGIC were the coverterms for high-level German and Japanese decrypts.
[6] John C. Sparrow, *History of Personnel Demobilization in the United States Army* (New York, NY: The Free Press, 1984), 21.
[7] James F. Schnabel, "The Joint Chiefs of Staff and National Policy, 1945-1947" in *The History of the Joint Chiefs of Staff* vol. I (Washington, DC: Office of Joint History, 1996), 97.
[8] Walter J. Boyne, *Beyond the Wild Blue: A History of the United States Air Force, 1947-2007* (New York, NY: Thomas Dunne Books, 2007), 26.

entire USAAF.[9] In the famous words of Chief of Staff of the Army General Marshall, "It wasn't demobilization, it was a rout."[10] In addition to the deep personnel cuts, the USAAF shrank from 68,400 aircraft at war's end to only 20,800 aircraft by the end of 1947.[11] The cuts were considerable, but they reflected America's sense of relief at the long war having finally ended. In the lean years following the war, there was understandably little progress in the USAAF's airborne ISR forces.

While the American public relished the return to normalcy, government foreign policy experts and military strategists doubted peace would last. During the war, tensions had surfaced between the USSR and the United States. Disagreements about the conduct of the war and particularly the USSR's aggressive, anti-democratic policy toward eastern European countries, made it clear that a confrontation between the world's two superpowers was inevitable. While the two sides had united to confront a common enemy during the war, communism and capitalism were diametrically opposed; conflict seemed certain. George Kennan's summer 1947 monograph on Soviet thinking, "The Sources of Soviet Conduct," solidified America's policy toward the Soviets.[12] From that moment, the United States became committed to stopping the spread of communism and preparing for a possible United States-Soviet Union confrontation. The postwar drawdown complicated the ability to support containment, but the United States' nuclear monopoly gave it the short-term advantage it required.[13] In the long-term, however, intelligence concerning the USSR's strengths, weaknesses, and

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[9] Ibid.
[10] United States Army Field Manual (FM) 100-17, Chapter 6, "Demobilization," in *Mobilization, Deployment, Redeployment, Demobilization* (Washington, DC: Headquarters Department of the Army, 1992), 1.
[11] Steven L. Rearden, "The Formative Years, 1947-1950," in *The History of the Office of the Secretary of Defense* vol. I, ed. Alfred Goldberg (Washington, DC: Office of the Secretary, Historical Office, 1984), 12.
[12] John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of American National Security Policy During the Cold War* (New York, NY: Oxford University Press, Inc., 1982), 24.
[13] Gregg Herken, *Counsels of War* (New York, NY; Oxford University Press, 1985), 47.

intentions was absolutely necessary.

Initially, ISR aircraft – typically modified C-47s, B-17s, or B-24s – based in Britain and occupied Germany conducted photomapping of large areas under Soviet control and likely future battlegrounds.[14] Under a project titled "Casey Jones," USAFE aircraft mapped nearly 2,000,000 square miles of Europe and North Africa.[15] While the IMINT was useful, the inability to obtain deep-range photographs along with the increased danger posed by Soviet air defenses, forced planners to search for other solutions. Unfortunately, their options were few. Refugees, former prisoners of war, German collaborators, and Soviet deserters were all sought out to provide intelligence on the USSR, but they simply could not generate the required level of detail.[16] To fully support the containment policy, the intelligence community needed to understand everything possible about the USSR. When technological advances in the 1950s permitted aircraft to fly out of the range of Soviet air defenses, airborne ISR would contribute significantly to increasing that understanding. For the time being, however, airborne ISR operations would rely on World War II-era aircraft to provide strategic intelligence.

Though the draconian cuts to the armed forces had greatly hamstrung the United States' ability to advance its airborne ISR programs, a miniscule, yet viable, capability remained. As early as autumn 1945, the United States began conducting ISR missions near the borders of Soviet-occupied territory. On 16 October 1945, the United States Navy tasked a PBM-5 Mariner patrol plane to observe a Japanese withdrawal of troops from an area near Port Arthur, Manchuria.[17] In addition to watching the Japanese, the Mariner's crew was ordered to

[14] Robert J. Boyd, "Project Casey Jones, Post-Hostilities Aerial Mapping," Strategic Air Command report, 30 September 1988, 1, K416.04-38, Air Force Historical Research Agency (AFHRA).
[15] Ibid.
[16] Curtis Peebles, *Twilight Warriors* (Annapolis, MD: Naval Institute Press, 2005), 9.
[17] Norman Polmar and Thomas B. Allen, *Spy Book: The Encyclopedia of Espionage* (New York, NY: Random House, Inc., 2004), 14.

collect information on Soviet operations in the area.[18] After the Mariner completed its reconnaissance mission and began its return-to-base, a Soviet fighter intercepted the Mariner and fired multiple shots at it. Approximately four months later, in a similar event, the Soviets intercepted another Navy Mariner near the town of Dairen, Manchuria.[19] While in the first incident, the Mariner was primarily observing the Japanese withdrawal, in this occurrence, the Mariner's primary mission was likely to conduct ISR collection on a Soviet radar installation in the area.[20] While both Mariners returned to base unscathed, the events marked what were to become common occurrences throughout the Cold War – Soviet complaints regarding violation of Soviet airspace and Soviet air defenses reacting violently to United States ISR aircraft. Following the second Mariner incident, the Soviets declared that American aircraft "must not approach within 12 miles of the coast … without permission from the Soviet command."[21] The gauntlet had been laid down; now American airborne ISR forces would have to prove they were brave enough to accept it.

The first major airborne ISR operation of the Cold War – Project Nanook – was conducted over the Arctic Ocean. The first war plan built in preparation for a confrontation with the Soviets – Joint Chiefs of Staff Emergency War Plan PINCHER – called for Alaska-based strategic bombers to strike targets in the USSR.[22] In days before aerial refueling,

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[18] The Soviet army had just occupied Port Arthur and was located less than two miles from the operating area of the Mariner.

[19] Roy A. Grossnick, *United States Naval Aviation, 1910-1995* (Washington, DC: Naval Historical Center, 1997), 773.

[20] William E. Burrows, *By Any Means Necessary* (New York, NY: Farrar, Straus and Giroux, 2001), 93.

[21] Associated Press, "Russ' Fire on U.S. Planes Protested by Capitol," *Milwaukee Sentinel*, 2 March 1946, available online at http://news.google.com/newspapers?id=GbwdAAAAIBAJ&sjid=BQ0EAAAAIBAJ&dq=mariner%20aircraft%20soviet&pg=5997%2C8153 (accessed on 10 March 2012). Additionally, this 12-mile rule, while not recognized at the time, would become the Department of State-ordered distance for future Cold War reconnaissance flights as part of the peacetime airborne reconnaissance program (PARPRO).

[22] Farquhar, *A Need to Know, 33*.

this meant that American bombers would need to take off from northern tier bases and fly directly over the Arctic zone in order to reach targets within the USSR. Before bombers could use these routes, however, ISR aircraft had to gather information about the operating conditions and potential divert areas in the Arctic. To obtain this information, the Strategic Air Command (SAC) formed its first operational unit– the 46th Reconnaissance Squadron[23] – and deployed it to Ladd Field outside of Fairbanks, Alaska.[24] To allow for long-duration sorties and to ensure no Soviet fighter aircraft could interfere, the squadron's nine B-29Fs – called F-13s or FB-29s[25] – were stripped of all gun turrets, had extra fuel tanks installed in their bomb bays, and were equipped with multiple types of long-range cameras.[26] One of the project's participants, Fred Wack, summarized the squadron's mission: "…the most important purpose of Nanook was the first goal of finding new lands if any existed, and for the United States to lay claims to these. Visual and radar photography of the arctic ice pack…and Soviet Coastal [sic] areas and military installations…were all added goals to the mission of the 46th."[27]

On 2 August 1946, the squadron conducted its – and SAC's – first operational mission.[28] In what would be a significant learning experience, the aircrew quickly confronted the difficulties of operating in Arctic conditions. According to the unit's history, the crew dealt with frozen aircraft tires, brakes, gear boxes, batteries, and oil lines – all

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[23] Lt Col George H. Peck, Chief, Media and Civil Relations, Office of Public Affairs, Strategic Air Command, to HQ USAFHRC and HQ SAC/HO, letter, "Subject: Manuscript Submission for Historical Record," 20 Oct 88, K-SQ-PHOTO-72-SU-PE, AFHRA.
[24] History, 46th Reconnaissance Squadron, 1 June–1 July 1946, 1, Sq-Photo-46-Hi, AFHRA.
[25] The "F" stood for photo. For additional information on the IMINT variant of the B-29, see Robert A. Mann, *The B-29 Superfortress: A Comprehensive Registry of the Planes and Their Missions* (Jefferson, NC: McFarland Publishing, 2004), 105.
[26] Ibid.
[27] Fred J. Wack, *The Secret Explorers: Saga of the 46th/72nd Reconnaissance Squadrons* (Turlock, CA: Seeger's Printing, 1992), 1.
[28] Alwyn T. Lloyd, *A Cold War Legacy: A Tribute to SAC, 1946-1992* (Missoula, MT: Pictorial Histories Publishing Company Inc., 1999), 65.

before takeoff.[29] Once airborne, the crew scoured the uncharted areas for land masses that SAC could potentially use as weather stations, divert bases, or forward operating areas. During ensuing sorties, the squadron mapped nearly the entire Arctic Ocean area and identified several locations that SAC would subsequently use as early warning radar bases.[30]

While these sorties gathered navigational information and developed standard operating procedures for Arctic flights, they also had a strategic intelligence value. In an operation known simply as Project 20, crews flew surveillance missions from Point Barrow, Alaska, to the end of the Aleutian chain.[31] During Project 20 flights, crews were tasked with photographing any Soviet naval or air vessels in addition to any "unusual object or activity."[32] In a separate program – Project 23 – aircrews combined IMINT and ELINT collection techniques.[33] In each Project 23 mission, two aircraft – one configured for ELINT and the other for IMINT – flew along the Siberian coast with the ELINT aircraft flying at high altitude "directly over the coastline," while the IMINT airplane flew a parallel course several miles out to sea.[34] The ELINT aircraft forced Soviet air defense radars to activate by flying in close proximity to the coast while the IMINT airplane imaged the radar sites based on geo-locational data collected by the ELINT platform.[35] While a theoretically sound technique, the cameras on the IMINT aircraft were simply not capable of producing usable imagery at the time. The practice, however, was a completely new innovation. As technology advanced, multi-

[29] History, 46th Reconnaissance Squadron, 1 Jun–31 Jul 1946, 3, 6, SQ-PHOTO-46-HI, AFHRA.
[30] *History Strategic Air Command 1948*, vol. 1, AFHRA, 248-249.
[31] Major Carl M. Green, Reconnaissance Branch, Air Intelligence Requirements Division, Directorate of Intelligence, to Chief, Air Intelligence Requirements Division, memorandum, "Subject: Coordination of Photo and Photo Intelligence Activities," 11 December 1947, RG 314, Box 40, NARA.
[32] Ibid.
[33] Project 23 should be viewed as a precursor to today's intelligence cross-cueing.
[34] Ibid.
[35] Ibid.

platform cross-cueing would become standard practice in the airborne ISR community.

These early sorties also highlighted the political complications accompanying airborne strategic intelligence collection. Following a 22 December 1947 combined ELINT/IMINT sortie, the Soviets issued a diplomatic protest over airborne ISR operations in the Arctic.[36] The Soviets claimed that an American aircraft violated Soviet airspace "for about seven miles along the coast of the Chukotsk Peninsula at a distance two miles from the shore."[37] The subsequent USAF investigation revealed that the aircraft had likely violated the Russian – and State Department – 12-mile restriction, but there was no method to determine if the aircraft had indeed overflown Soviet territory.[38] Additionally, the USAF had not implemented a policy that directed its aircrews to adhere to the 12-mile limitation.[39] In the end, no fault was assigned and the Americans answered the Soviet demarche by simply blaming bad weather for any possible violations.[40] While no disciplinary actions were taken, the incident was the first of countless sovereignty violations and subsequent complaints that would come to characterize strategic airborne ISR during the Cold War.

While the 46th Reconnaissance Squadron was conducting its IMINT sorties over the Arctic Ocean, SAC began flying dedicated ELINT collection missions along potential Arctic bombing routes. To ensure its bombers' survivability, SAC required locational and operational data on the Soviet radars along their planned attack routes. In September 1946,

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[36] Lloyd, *A Cold War Legacy*, 67.
[37] Soviet Note Number 261, Embassy of the Union of Soviet Socialist Republics, 5 January 1948, RG 341, Box 40, NARA.
[38] Air Intelligence Requirements Division, Collection Branch, to, Commander in Chief, Alaska, letter, "Subject: Violations of Soviet Frontier," no date given, RG 341, Box 41, NARA.
[39] "Subject: Photographic Coverage – Chukotski Peninsula," memorandum, no date or author given, RG 341, Box 41, NARA.
[40] Paul Lashmar, *Spy Flights of the Cold War* (Annapolis, MD: Naval Institute Press, 1996), 41.

SAC aircrews operating from Thule Air Base, Greenland, and Meeks Field, Iceland, flew multiple sorties to determine the extent of Soviet radar coverage.[41] These sorties, however, did not penetrate Soviet airspace; the resulting collection was therefore inconclusive.

In frustration at the continued lack of information on Soviet radar locations and capabilities along with the inaccurate map data of the Soviet coastline, on 5 April 1948, the Secretary of the Air Force, Stuart Symington, sent a letter to General Carl Spaatz, the Chief of Staff.[42] In the letter, Symington relayed his concern about the lack of detail and urged Spaatz to authorize direct overflight of the USSR. Spaatz agreed and on 5 August 1948, the 46th Reconnaissance Squadron conducted what is recognized as the first authorized mission whose intent was to overfly the USSR.[43] Using completely stripped F-13A aircraft, the aircrews were able to achieve altitudes of 35,000 feet. With the increased altitude, the F-13A – called Dreamboats by the aircrews of the 46th – were able to fly above all Soviet air defenses.[44] During the 19 hour sortie, the aircrew flew deep into Siberia and obtained unprecedented images of Soviet radar sites along with detailed photography of the Russian littoral area.[45]

Aerial routes over the Arctic were not the USAF's only concern, however. As the Iron Curtain descended across eastern Europe, knowledge of Soviet radar capabilities became of utmost importance to air war planners at USAFE. To gain appreciation of the extent of Soviet radar coverage in Eastern Europe, USAFE formed the 7499th Squadron and equipped it with modified B-17 Ferret ELINT aircraft.[46] Beginning in 1947, the 7499th flew three missions per month along the Germany-

[41] Norman Polmar, *Spyplane: The U-2 History Declassified* (Osceola, WI: MBI Publishing, 2001), 6.
[42] Alwyn T. Lloyd, *A Cold War Legacy*, 68.
[43] Ibid.
[44] Wack, *The Secret Explorers*, 82.
[45] Ibid.
[46] Farquhar, *A Need to Know*, 41.

Austria border searching for Soviet radar installations.[47] During these sorties, the electronic warfare officers, or "crows," detected the presence of multiple Soviet early warning radars and one antiaircraft radar in Yugoslavia.[48] Additionally, the 7499th flew covert missions during the Berlin Airlift. Aircraft from the squadron would join the steady stream of airplanes coming into and out of Berlin.[49] As Soviet radar could not distinguish the B-17s from the other types of authorized aircraft, the move provided the aircraft with a deeper look into Soviet-occupied Germany and allowed the squadron to gain a better understanding of Soviet radar capability. While these sorties did not permit a comprehensive appreciation of Soviet air defenses, they did provide USAFE with an initial estimate of Soviet defensive capability in eastern Europe.[50]

The early airborne ELINT flights provided useful information regarding Soviet peripheral defenses. As war plan PINCHER called for aerial attacks on 30 Soviet cities, however, SAC faced a major intelligence shortfall which complicated its ability to plan. The peripheral radar information provided no actual intelligence on the Soviet economy or industrial infrastructure and greatly limited the efficacy of any strategic air attack. Not satisfied with the situation, SAC Commander, General Curtis LeMay, complained to the USAF Chief of Staff, General Hoyt Vandenberg. In December 1950, Vandenberg asked Dr. Bernard Brodie – the world-renowned expert on atomic strategy – to review the PINCHER target list.[51] Brodie's critique of the target list was harsh. Brodie – like LeMay – felt the targets had been selected arbitrarily and that the effects resulting from attacks on them would also be arbitrary. Brodie recommended that SAC conduct a thorough analysis of the Soviet

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47 History, 7499th Air Force Squadron, 1 July–31 December 1949, Sq-Comp-7499-HI, AFHRA.
48 Ibid.
49 Lashmar, *Spy Flights of the Cold War*, 33.
50 Farquhar, *A Need to Know*, 41.
51 Lashmar, *Spy Flights of the Cold War*, 61.

industrial complex before building its target folders. Brodie was convinced that the PINCHER target list would not produce the predicted Soviet collapse. Armed with Brodie's review, Vandenberg had the catalyst he needed to prompt action from the White House.

In order to refine the target list and obtain actionable targeting information, after much persuasion, President Harry Truman authorized SAC to institute a program to obtain IMINT of Soviet ports, islands, and coastal areas.[52] While Truman did not explicitly permit overflight, USAF planners were given ample leeway to get the information they required.

To take full advantage of the new authorization, the USAF ordered strategic reconnaissance versions of its long-range Convair B-36 Peacemaker and North American B-45 Tornado bombers. The Peacemaker was the first to be converted. To start the conversion, a standard B-36 was first stripped of all unnecessary equipment and armament. Designers then outfitted the enormous bomber with near and long-distance camera arrays along with additional fuel tanks to extend the aircraft's range.[53] After the conversions, the new aircraft – known as the RB-36D/E/F – had an unrefueled flight endurance of 50 hours[54] and was able to obtain altitudes approaching 58,000 feet.[55] This unprecedented flight duration and altitude allowed the aircraft to deeply penetrate the USSR and fly virtually unmolested by Soviet air defenses.

The B-45's conversion to a strategic ISR asset required fewer modifications than the RB-36Ds. Designed as the USAF's first jet bomber, the B-45 relied on speed to elude hostile air defenses.[56] The

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[52] Curtis Peebles, *The Moby Dick Project* (Washington, DC: Smithsonian Institute Press, 1991), 99.
[53] Meyers K. Jacobsen, *Convair B-36: A Comprehensive History of America's "Big Stick"* (Atglen, PA: Schiffer Publishing, 1997), 100.
[54] Gordon Swanborough and Peter M. Bowers, *United States Military Aircraft Since 1909* (Washington, DC: Smithsonian Institute Press, 1989), 189.
[55] Curtis Peebles, *Dark Eagles: A History of Top Secret U.S. Aircraft* (New York, NY: Simon & Schuster, 1995), 19.
[56] Ibid.

main modification was the replacement of the bombardier's position with a camera bay. This allowed mission planners to utilize specific cameras according to the target they were flying against. If the aircraft was to fly directly over the target, planners would install a package that included a total of 12 cameras.[57] If the target would not be directly overflown, a camera with a 100-inch focal lens was installed. This allowed for very high resolution oblique IMINT from large stand-off distances. Additionally, designers installed passive ELINT collection equipment in the aircraft's bomb bay. Finally, designers added an extra fuel tank which extended the aircraft's range to over 2,500 miles.[58]

By early 1951, the RB-36D and the RB-45C were probing Soviet air defenses. In January, RB-36Ds operating from Great Britain's RAF Lakenheath flew a series of IMINT collection missions over the Soviet military base complex at Murmansk on the Kola Peninsula.[59] While MiG fighters reacted to the aircraft, they were unable to intercept the high-flying RB-36Ds. Later in 1951, RB-36Ds operating from RAF Sculthorpe conducted multiple sorties against what appeared to be a large nuclear weapons test complex on the island of Novaya Zemlya in the Barents Sea.[60] IMINT collection from these sorties confirmed the complex' purpose and most Soviet nuclear testing would eventually occur there from 1958 to 1964. The Soviets' inability to respond to these sorties led the Soviet Air Ministry to order an all-weather fighter capable of intercepting the American ISR aircraft. It was not until 1956, however, with the introduction of the Soviet Yakovlev Yak-25, that American strategic ISR flights were truly threatened.[61]

While the RB-36Ds were testing Soviet resolve by directly overflying sensitive northern tier Soviet bases, the United States and Great Britain

[57] Swanborough, *United States Military Aircraft Since 1909*, 479.
[58] Ibid., 480.
[59] Polmar, *Spy Book*, 43.
[60] Robert Jackson, *High Cold War: Strategic Air Reconnaissance and the Electronic Intelligence War* (Newbury Park, CA: Haynes North America Inc., 1998), 56.
[61] Ibid.

undertook a program to obtain the targeting information that SAC – and Britain's Bomber Command – greatly needed. With the beginning of the Korean War, President Truman had implemented restrictions on strategic ISR flights limiting them to the Baltic Sea area.[62] Designed to alleviate tensions with the USSR, the restrictions severely hampered SAC's ISR efforts. Truman understood the impact of his restrictions, however, and in December 1950, he and British Prime Minister Clement Attlee agreed to a plan whereby the RAF would fly American RB-45Cs over the USSR.[63] The plan gave plausible deniability to both nations. The RAF removed all American markings from the airplanes and replaced them with the British roundel. In the event of the loss of an aircraft in Soviet territory, the British would simply deny that they possessed any RB-45s in their inventory. After a lengthy training period, the RAF crews began flying sorties over the USSR in April 1952.

Over the next two years, the RAF conducted multiple RB-45C sorties over areas of the USSR that had not been previously photographed. On a typical operation, three RB-45C aircraft would take-off almost simultaneously, rendezvous with a USAF refueling tanker near Denmark and then split along three flight paths over the USSR: one over the Baltic States, one in the Moscow area, and one over central southern USSR.[64] While the intelligence gained was landmark, it did not provide the level of detail that planners had hoped. In a 16 December 1952 letter from RAF Air Chief Marshal Sir Hugh P. Lloyd to USAF 7th Air Division Commander Major General John P. McConnell, Lloyd lamented that the operation had not satisfied SAC's intelligence requirements.[65] The simple fact that the flights continued for two years – despite the low value of the intelligence – underlines SAC's desperate situation. With

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[62] Farquhar, *A Need to Know*, 137.
[63] Curtis Peebles, *Shadow Flights: America's Secret War Against the Soviet Union* (Novato, CA: Presidio Press Inc., 2000), 15.
[64] Ibid., 24.
[65] Jackson, *High Cold War*, 53.

only peripheral airborne SIGINT and a still unsatisfactory IMINT capability, USAF – and CIA – planners began to explore aircraft that could finally give them the deep look into the USSR that they so urgently needed.

In 1946, Colonel Richard Leghorn – who had commanded the 30th Photographic Reconnaissance Squadron during World War II and flown IMINT missions over Normandy in preparation for the D-Day invasion[66] – set the stage for the future of strategic airborne ISR in comments he made to a symposium of photographic experts. In his remarks, Leghorn stated:

> …it is unfortunate that whereas peacetime spying is considered a normal function between nation states, military aerial reconnaissance – which is simply another method of spying – is given more weight as an act of military aggression. Unless thinking on this subject is changed, reconnaissance flights will not be able to be performed in peace without permission of the nation state over which the flight is to be made. For these reasons, it is extraordinarily important that a means of long-range aerial reconnaissance be devised which cannot be detected. Until this is done, aerial reconnaissance will not take its rightful place among the agents of military information protecting our national security prior to the launching of an atomic attack against us.[67]

Leghorn's words were prophetic. The United States' strategic airborne ISR efforts through 1954 were insufficient. As he had predicted, ISR flights flying only on the target nation's periphery prevented the United States from obtaining the level of intelligence it needed to prepare for strategic air warfare. As Brodie, SAC, and the USAF had highlighted in their repudiation of the PINCHER plans, there was a complete dearth of intelligence about Soviet capabilities. Something simply had to change.

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[66] Air Force Space Command official website, "Biography of Colonel Richard Sully Leghorn," http://www.afspc.af.mil/library/biographies/bio.asp?id=9942 (accessed on 13 March 2012).
[67] Quoted in Chris Pocock, *Dragonlady: The History of the U-2 Spyplane* (Osceola, WI: Motorbooks International Publishers and Wholesalers Inc., 1989), 2.

In 1951, the USAF established Project Lincoln – later known as Lincoln Laboratory – at Boston's Massachusetts Institute of Technology (MIT) to conduct research on air defense.[68] Its first project was a special study codenamed Beacon Hill, whose purpose was to evaluate the airborne ISR problem. Under Beacon Hill, some of the nation's finest scientific minds –known as the Beacon Hill Group – came together to search for ways to improve airborne ISR. During the first half of 1952, the group spent every weekend at MIT receiving briefings and brainstorming high-flying aircraft and reconnaissance balloon projects.[69] On June 15, Beacon Hill issued its initial report titled *Problems of Air Force Intelligence and Reconnaissance*. While much of the report reflected many of the radical ideas the scientists and engineers had discussed, it fully supported the idea of pursuing high-altitude ISR. In the report's conclusion, the Beacon Hill group wrote:

> We have now reached a period in history when our peacetime knowledge of the capabilities, activities, and dispositions of a potentially hostile nation is such as to demand that we supplement it with the maximum amount of information obtainable through aerial reconnaissance. To avoid political involvements, such aerial reconnaissance must be conducted either from vehicles flying in friendly airspace, or…from vehicles whose performance is such that they can operate in Soviet airspace with greatly reduced chances of detection or interception.[70]

The report gave the USAF the independent backing that it needed to pursue its first-ever custom-built airborne ISR aircraft.

Fortunately for the USAF, concurrent to the Beacon Hill study, the visionary Colonel Leghorn had assumed a position at the Air Staff working for then-Colonel Bernard Schriever in the Office of

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[68] Eva C. Freeman, *MIT Lincoln Laboratory: Technology in the National Interest* (Boston, MA: Lincoln Laboratory, 1995), 8.
[69] Peebles, *Shadow Flights*, 63.
[70] Quoted in L. Parker Temple, *Shades of Gray: National Security and the Evolution of Space Reconnaissance* (Reston, VA: American Institute of Astronautics and Aeronautics, 2005), 51.

Developmental Planning (ODP).[71] Leghorn's assignment put him in charge of planning the USAF's ISR development where his main mission was to create requirements for airborne ISR's Cold War evolution. Among his major achievements while at the Air Staff was his recommendation that the USAF build a specialized, high-altitude, lightweight aircraft capable of conducting covert missions at altitudes of greater than 70,000 feet.[72] While not adopted at the time, the requirement laid the foundation upon which Leghorn's successors would build.

In late 1952, engineers at the New Developments Office of the Bombardment Aircraft Branch at Wright Field, Ohio, conceptualized what would ultimately become the U-2.[73] Having witnessed the introduction of the jet-powered B-45, USAF Major John Seaberg and two German aeronautical experts – Woldemar Voight and Richard Vogt[74] – conceived an airframe that combined a turbojet engine with a streamlined airfoil and low wing load.[75] Their imagined aircraft would achieve unprecedented altitudes and be almost invisible to any existing radars. With the urgency for intelligence on the USSR still paramount, Seaberg began creating a set of specifications. In March 1953, Seaberg's requirement was ready and he issued a request for proposals to the American aircraft industry. Seaberg's request was for "an aircraft that had an operational radius of 1,500 nautical miles and was capable of conducting pre- and post-strike reconnaissance missions during daylight."[76] The requirement also stated that the aircraft had to have "an optimum subsonic cruise speed at altitudes of 70,000 feet or higher over

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[71] Herbert F. York and G. Allen Greb, "Strategic Reconnaissance," *Bulletin of the Atomic Scientists* 33, no. 4 (April 1977): 33.
[72] Peebles, *Shadow Flights*, 65.
[73] Pocock, *Dragon Lady*, 3.
[74] Gregory W. Pedlow and Donald E. Welzenbech, *The CIA and the U-2 Program, 1954-1974* (Langley, VA: CIA Center for the Study of Intelligence, 1998), 8.
[75] Pocock, *Dragon Lady*, 3.
[76] Pedlow, *The CIA and the U-2 Program*, 8.

the target, carry a payload of 100 to 700 pounds of reconnaissance equipment, and have a crew of one."[77] Finally, Seaberg outlined an additional requirement that would have ramifications on many future USAF aircraft. Under the category "Detectability," Seaberg requested, "Consideration will be given in the design of the vehicle to minimize the detectability by enemy radar."[78]

In an interesting move, the USAF sent Seaberg's requirement to only three small aircraft companies – Bell Aircraft Corporation, Fairchild Engine and Airplane Company, and Martin Aircraft Company – completely bypassing the major aircraft contractors of the time.[79] While all three set about building models to meet the USAF's requirements, a fourth company entered the process. Though the USAF had not solicited his company, the assistant director of Lockheed Aircraft, John "Jack" Carter, heard about the project.[80] As Lockheed was in the process of building the F-104 – the USAF's first production Mach 2 fighter – Carter felt his company could produce an aircraft suitable for the USAF's requirements. He turned the project over to the mastermind behind the F-104, an aviation designer named Clarence "Kelly" Johnson. Johnson had been involved in Lockheed's World War II XP-80 project – USAAF's first operational jet fighter[81] – along with the F-104 and was perfectly suited to lead Lockheed's effort.

Within a few short months, Johnson developed a new aircraft design by using the F-104 fuselage and adding high-aspect ratio wings. As the F-104 had already achieved altitudes of over 100,000 feet, Johnson was certain that his new model – which he called the CL-282 –

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[77] Ibid.
[78] Peebles, *Dark Eagles*, 19.
[79] The USAF believed that large aviation corporations would not treat the project with the attention it deserved. They were certain a large production run was unlikely and wanted more of a craftsman-type approach to the project.
[80] Peebles, *Shadow Flights*, 67.
[81] William Green and Gordon Swanborough, *The Great Book of Fighters* (St. Paul, MN: MBI Publishing, 2001), 345.

would have no problems meeting the USAF requirements.[82] In March 1954, Johnson submitted his idea to now Brigadier General Schriever's ODP. Schriever approved the concept and brought Johnson to the Pentagon to brief USAF Vice Chief of Staff General Thomas White.[83] White also authorized the production of a small number of CL-282s with the caveat that Schriever would have to get General LeMay's approval.[84] In early April, three members of Schriever's ODP team traveled to Omaha to brief LeMay.[85] The briefing was a complete failure. LeMay was not interested in establishing a separate ISR unit within SAC and was content with obtaining IMINT from his RB-36Ds.[86] According to one attendee, halfway through the briefing, LeMay stormed out remarking that the "whole business was a waste of his time."[87] On June 7, Lockheed received official rejection notification from the Air Staff.[88]

Lockheed was undeterred by the USAF rejection and continued to push the CL-282 program to anyone who would listen. Having grown increasingly concerned about the possibility of a Soviet surprise attack on the United States, in July 1954, President Dwight Eisenhower established the Technological Capabilities Panel (TCP) to pursue scientific solutions to the United States' defense challenges.[89] One of the members of the group, Dr. Edwin Land, had received a briefing on the CL-282 prior to the group's formation. After gaining approval from the other panel members, on 5 November 1954, Land wrote a letter to the Director of the Central Intelligence Agency (CIA), Allan Dulles, recommending the agency pursue the CL-282 due to the aircraft's ability to "quickly bring so much vital information at so little risk and at so little

[82] Jackson, *High Cold War*, 105.
[83] Peebles, *Shadow Flights*, 67.
[84] As SAC would be the ultimate user of the CL-282, White wanted to ensure LeMay approved of the concept before it progressed.
[85] Pedlow, *The CIA and the U-2 Program*, 11.
[86] Peebles, *Shadow Flights*, 67.
[87] Pedlow, *The CIA and the U-2 Program*, 12.
[88] Pocock, *Dragon Lady*, 7.
[89] Pedlow, *The CIA and the U-2 Program*, 27.

cost."[90] Dulles demurred opining that he believed the CIA's focus should remain clandestine intelligence collection.[91] Land was undeterred, however, and sought a higher-level audience. During a TCP update to Eisenhower, Land and the TCP Chair James Killian pitched the CL-282 idea. After hearing the proposal, Eisenhower approved the project with the stipulation that "it should be handled in an unconventional way so that it would not become entangled in the bureaucracy of the Defense Department or troubled by rivalries among the services."[92] With the President's approval, Lockheed began immediate production and on 1 August 1955, the first two prototypes began test flights.[93]

In April 1956 – just eight months after its first flights – the U-2 deployed for the first time. In mid-April, two U-2s were loaded onto two C-124 transport aircraft and flown to RAF Lakenheath in England.[94] The first U-2 squadron – known by its cover name as the 1st Weather Reconnaissance Squadron – accepted the aircraft and prepared them for Soviet overflight.[95] The CIA only flew test flights from England and later decided to rebase the U-2s at Wiesbaden Air Base in Germany. On 20 June 1956, the CIA conducted the first operational U-2 flight with a short flight over eastern Europe. U-2 program managers were happy with the results and sought Eisenhower's approval to proceed. On July 4, the U-2 flew its first sortie over Soviet territory. The pilot, Hervey Stockman, flew directly over East Berlin, Poland, and Belarus. Leaving Belarus, Stockman headed north toward Leningrad. As he crossed into Russian territory, the Soviet Air Force began reacting. Contrary to American hopes, the Soviets could indeed see the U-2 and were

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[90] Quoted in Peebles, *Dark Eagles*, 22.
[91] Pedlow, *The CIA and the U-2 Program*, 32.
[92] James Rhyne Killian, *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology* (Cambridge, MA: MIT Press, 1977), 58.
[93] Pocock, *Dragon Lady*, 14.
[94] Ibid., 25.
[95] Jeffrey T. Richelson, *A Century of Spies: Intelligence in the 20th Century* (New York, NY: Oxford University Press, 1995), 265.

vigorously trying to shoot it down. Stockman could see MiG fighters below him, but he continued on with little choice but to trust the aircraft's designers.[96] Stockman finished his sortie without incident. Building on the success, four additional sorties were flown over the next several days with one of the sorties flying directly over Moscow. The images the U-2 took during these flights provided unprecedented views of military installations deep in Soviet territory. These first flights revealed much about the USSR's order of battle. Flights over Soviet airfields showed the number of Bison and Bear strategic bombers was significantly lower than Pentagon estimates.[97] The lack of bombers disproved the bomber gap trumpeted by many politicians and gave the Eisenhower administration breathing room to form a more comprehensive defense strategy.[98]

These U-2 sorties forever changed the Cold War. From 4 July 1956, the United States would no longer guess about Soviet military capabilities and order of battle. U-2 flights over the USSR continued through the 1 May 1960 Francis Gary Powers shoot down incident, but by that time, the United States had begun to earnestly collect IMINT from space satellites and had started work on the faster, stealthy SR-71 aircraft.[99] While the use of satellite imagery would expand throughout the Cold War, the U-2 had unequivocally proven the importance of manned airborne IMINT. Though the development of enhanced air defense systems ultimately forced the United States to use manned airborne IMINT assets in permissive environments, the flexibility they provided cannot always be supplanted by satellites. The USAF's recent decision to indefinitely delay the U-2s retirement only highlights this

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96 Pocock, *Dragon Lady*, 27.
97 Dick van der Aart, *Aerial Espionage* (New York, NY: Prentice Hall Press, 1984), 30.
98 Peebles, *Dark Eagles*, 39.
99 Jackson, *High Cold War*, 131.

point.[100] As will be seen, the aircraft's ability to support both strategic and tactical intelligence requirements has proven irreplaceable.

While airborne ELINT and IMINT collection progressed rapidly through the 1950s, airborne COMINT was much slower to develop. Following World War II, airborne COMINT was almost entirely neglected. Since it had only a marginal strategic impact during the war, air force commanders saw little need to pursue it. Though USAF leaders did not advocate for airborne COMINT, the service's remaining COMINT squadrons did. In early 1950, the 1st Radio Squadron Mobile (RSM) explored ways it could place Russian airborne linguists on the ferret aircraft of the 91st Strategic Reconnaissance Squadron (SRS).[101] When rejected by the 91st SRS, 1st RSM leadership convinced Far East Air Forces (FEAF) Commander General George Stratemeyer, of the need for airborne COMINT.[102] Stratemeyer assigned a C-46 aircraft to the 1st RSM and by the end of April 1951, the squadron had begun experimental flights.[103]

Also in 1950, the United States Air Force Security Service (USAFSS) – the organization charged with overseeing all USAF SIGINT operations – began to pursue an airborne COMINT capability. After studying the theoretical feasibility of performing dedicated airborne COMINT missions, First Lieutenant Fred Smith created the first specifications for a purpose-built airborne COMINT platform.[104] Smith turned his specifications into a requisition request and asked Headquarters Air Force (HAF) to give USAFSS four B-50 bombers. His request was denied, but HAF did apportion a B-29 for USAFSS to use as

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100 Lolita C. Baldor, "Pentagon Ending Air Force's Global Hawk Program," *Navy Times*, 24 January 2012, http://www.navytimes.com/news/2012/01/ap-pentagon-ending-air-forces-global-hawk-program-012412/ (accessed 17 March 2012).
101 History, 1st Radio Squadron Mobile, 1 August 1949-30 April 1950, 160.032-76, AFHRA.
102 Ibid.
103 Ibid.
104 Larry Tart and Robert Keefe, *The Price of Vigilance: Attacks on American Surveillance Aircraft* (New York, NY: Ballantine Books, 2001), 179.

a test bed.

In October 1951, USAFSS began modifying the B-29 for its COMINT mission and in June 1952, the aircraft deployed to the 91st SRS to fly operational missions in the Sea of Japan and in Korea.[105] Subsequent deployments to Alaska, Europe, and North Africa solidified the value of airborne COMINT operations. The RB-29 had shown that it could gather intelligence from remote areas that were completely unreachable by ground intercept sites. Using the results of these sorties as proof, USAFSS again lobbied HAF for B-50 aircraft. This time, USAFSS obtained the backing of the newly formed National Security Agency (NSA) who controlled the funding for cryptologic operations. With NSA's support, USAF approved ten RB-50s – five for Europe and five for the Far East.[106] In December 1955, the USAF awarded the conversion contract to the Texas Engineering & Manufacturing Company (TEMCO) – the same company that had spearheaded the B-29 conversions – and work immediately began on converting the first B-50.[107]

With the RB-50, airborne COMINT collection could truly expand. The USAF had configured the RB-29 as primarily a Morse code intercept platform and had only placed one voice intercept position on the aircraft.[108] As experience with the RB-29 grew, however, it soon became clear that linguists – not Morse operators – were the key to truly gaining a comprehensive understanding of Soviet systems. After the successful installation and operational use of additional voice intercept positions on the USAFSS' RB-29, planners envisioned the RB-50 as primarily a voice

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105 Ibid., 181.
106 Ibid., 185.
107 Lance Martin, History of Majors Field, "Plane Better: Majors Field Contractor Celebrates More Than 50 Years of Improving Aircraft," date unknown, available online at http://www2.l-3com.com/is/50th/Majors_Field_history.pdf (accessed on 17 March 2012).
108 As the understanding of the value of voice intercept was still not clear, planners undoubtedly followed the World War Two model. The voice intercept operator was still thought of as a "Direct Support Operator;" the strategic importance was yet to be appreciated.

intercept platform.[109] In summer 1956, TEMCO completed the conversion and the new RB-50s were assigned to the 6091st SRS at Johnson AFB, Japan, and the 7406th Support Squadron (SS), at Rhein-Main AB, Germany.[110]

With the RB-50, the USAFSS established a new precedent for airborne SIGINT collection. The RB-50 would be the last SIGINT aircraft built through an ad hoc process of retrofitting intelligence collection gear into existing platforms. As such, before TEMCO had even completed the B-50 conversions, the USAF had already identified the RB-50's replacement.

In April 1957, the USAF awarded TEMCO with a contract under the newly formed "Big Safari" program to convert ten new C-130 transport aircraft into dedicated SIGINT collection platforms.[111] As opposed to previous programs in which TEMCO modified old platforms, under Project Sun Valley,[112] TEMCO received new aircraft directly from the Lockheed C-130 plant in Marietta, Georgia.[113] To create the best design and maximize available space, engineers stripped all pre-installed equipment from the aircraft before installing the collection equipment. The result was a major leap forward – both in capability and crew comfort. The newly designated C-130A-IIs contained ten voice intercept positions, a crew rest area, a galley, and even an airline-type toilet.[114] Airborne collection had truly evolved from the days of the Nisei flying in converted bomb bays in the bellies of B-24 aircraft. The USAF's newest ISR platform solidified airborne collection as a fundamental capability for air forces and from the Sun Valley project forward, the USAF would never be without a purpose-built airborne SIGINT collection aircraft in its

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109 "Quick reaction capability" is reconnaissance lingo for adding a capability to an aircraft after production. For further information see, Martin, *Plane Better*, 4.
110 Tart, *The Price of Vigilance*, 192.
111 Martin, *Plane Better*, 4.
112 Peebles, *Shadow Flights*, 219.
113 Tart, *The Price of Vigilance*, 214.
114 Ibid.

inventory.

In mid-1958, the 6091st SRS and the 7406th SS began receiving the C-130A-II and by the end of the year, both squadrons had completed the conversion to the new aircraft and were flying almost daily sorties.[115] With the increase in flights along the periphery of the USSR, the risk of shootdown also increased. During the 1950s and 1960s, there were countless incidents of Soviet aircraft intercepting American airborne reconnaissance platforms. In at least 13 of these incidents, the Soviets shot down the American aircraft.[116] Despite the danger, the strategic intelligence that the evolved capability provided was irreplaceable. Ground SIGINT collection sites were capable, but their range was limited. The airborne SIGINT platform – much like its IMINT brethren – was able to provide commanders with the flexibility needed to reach anywhere on the globe.

While flights over the USSR and along its periphery were providing extremely valuable strategic intelligence, airborne ISR platforms would be put to even greater tests over Cuba. Many believe the Cuban Missile Crisis jolted an unaware intelligence community in October 1962. President John F. Kennedy's public warnings regarding Soviet influence in Cuba occurred the month before missiles were detected on the island, however.[117] This simple fact reveals that the administration knew more about the Soviet buildup in Cuba than has been previously appreciated. Recent declassified NSA documents show that airborne ISR assets were gathering intelligence at least 18 months before the well-known incident drew the nation's attention.

Prior to the failed Bay of Pigs invasion of 17 April 1961, the

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[115] History, 7499th Support Group, 1 July-31 December 1958, K-GP-SUP-7499-HI, AFHRA.

[116] "Maybe You Had to Be There: The SIGINT on Thirteen Soviet Shootdowns of U.S. Reconnaissance Aircraft," *Cryptologic Quarterly*, Summer 1993, 1.

[117] Raymond L. Garthoff, "US Intelligence in the Cuban Missile Crisis," in *Intelligence and the Cuban Missile Crisis*, eds. James G. Blight and David A. Welch (Portland, OR: Frank Cass Publishers, 1998), 18.

intelligence community paid scant attention to Cuba. Shortly after the event, however, SIGINT collectors began to detect Soviet-type radar emissions from the island and Marine Corps airborne tactical IMINT sorties identified Soviet Firecan mobile fire control radars in two locations on the island.[118] Finally, on 1 May, Fidel Castro publically announced that Cuba's government would follow the Communist model.[119] Following these three events, interest in Cuba skyrocketed. Realizing its overall collection capability against Cuba was poor, the NSA initiated a series of steps to ensure American policymakers understood the events unfolding on the island. Part of these actions including increased airborne and shipborne SIGINT collection capability. Unfortunately, while the USAFSS had flown a few airborne ELINT missions against Cuba in 1960, the general focus remained the USSR.[120] This meant USAFSS – and the rest of the intelligence community – needed to divert resources to focus on the Cuban problem.

The first USAFSS contribution was to loan Spanish linguists to the NSA to assist in collection and transcription efforts. As all intelligence agencies had been focused on the Soviets, even NSA had a shortage of Spanish linguists. USAFSS' second major contribution was its conduct of airborne hearability tests around Cuba.[121] In June 1962, one of its C-130A-IIs began conducting dedicated collection missions and shortly thereafter a second aircraft arrived.[122] USAFSS' flexibility in creating a Cuban collection capability in such short time is commendable. USAFSS scoured the personnel from its units worldwide and identified airborne linguists and ground transcribers who were familiar with the Spanish language. These airmen were brought together and began conducting

[118] Donald C. Wigglesworth, "The Cuban Missile Crisis: A SIGINT Perspective," *Cryptologic Quarterly*, Spring 1994, 78.
[119] Theodore Draper, *Castro's Revolution: Myths and Realities* (New York: Frederick A. Praeger, 1962), 115.
[120] Wigglesworth, *The Cuban Missile Crisis*, 79.
[121] Ibid., 84.
[122] Ibid.

daily sorties against Cuban targets. Their skills coalesced quickly and on 10 October 1962, the C-130A-II detachment produced a SIGINT report that provided evidence that Cuban air defense personnel were using the Soviet aircraft tracking system and that they were conducting aircraft tracking in real-time.[123] This report showed that the Cubans now likely had a viable early warning radar system and could detect aircraft operating in and around Cuban air space. Airborne SIGINT flights continued throughout the crisis. While most information remains classified, if the report above is any indication of the performance of the USAFSS crews, it is certain that they made lasting contributions to the overall understanding of Cuban and Soviet capabilities and intentions.

The success of strategic airborne IMINT in the Cuban Missile Crisis is well-known, but should not be understated. As American satellite reconnaissance was still in its nascent stages and was oriented to provide coverage of the USSR, policy makers leaned heavily on airborne IMINT to provide the imagery the satellites could not. Due to the increased focus on Cuba, the CIA began conducting bi-monthly U-2 overflights in spring 1962.[124] On 29 August, a U-2 returned photographic proof that Soviet SA-2 missiles were installed on the western side of the island and subsequent sorties revealed additional SA-2 sites and MiG-21 interceptors in the central regions of the island.[125] As the SA-2 was the same missile that downed Powers' U-2 in 1960, intelligence planners feared U-2 overflight of Cuba would soon be halted and they would lose their main source of IMINT. With this in mind, they doubled the number of missions and on 14 October 1962, a U-2 piloted by Richard S. Heyser took the famous photographs of the nuclear missile

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[123] Declassified NSA report, serial number redacted, 10 October 1962, online, http://www.nsa.gov/public_info/_files/cuban_missile_crisis/10_october_intercept.pdf (accessed 18 March 2012).
[124] Pocock, *Dragon Lady*, 75.
[125] Jackson, *High Cold War*, 116.

preparations underway near San Cristobal.[126] Follow-on flights discovered additional missile sites, MiG-21 aircraft, and even Il-28 bombers.[127]

When President Kennedy was shown the imagery, the world spiraled into the well-known crisis that was ultimately resolved through a naval blockade and concessions on both sides. Airborne strategic IMINT collection had saved the Americans. Without the U-2 flights, the SIGINT alone would not have been sufficient to unequivocally prove the presence of the nuclear weapons on Cuba.[128] Given an additional few weeks, the Soviets would likely have been able to present a *fait accompli* to the United States; a move that would have incredibly weakened the American's bargaining position. Throughout the crisis, Kennedy relied on the U-2 – and Navy tactical IMINT assets – to provide updates regarding the extent and status of the missile installations. Even when Major Rudolph Anderson's U-2 was shot down by an SA-2 on 27 October – during the height of the crisis – Kennedy continued the overflights; the value of the intelligence was simply worth the risk.

Strategic IMINT and SIGINT collection in the Cuban Missile Crisis unquestionably contributed to the ultimate peaceful resolution. Following the crisis, both the Soviets and the Americans entered a period marked by less direct confrontations and the tactics of strategic airborne ISR reflected this less aggressive stance. Direct overflights of the USSR were not authorized. Satellites provided the necessary imagery for strategic air warfare planning and SIGINT satellites began to come online in May 1962.[129] While direct overflight was not authorized, periphery

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[126] Pocock, *Dragon Lady*, 78.
[127] Ibid.
[128] Further attesting to the value of the U-2 imagery is the fact that United States Ambassador to the United Nations, Adlai Stevenson, showed the U-2 images to the world in order to discredit the Soviet claims that they were only installing defensive weapons in Cuba.
[129] William E. Burrows, *Deep Black: Space Espionage and National Security* (New York, NY: Random House Inc., 1986), 221.

flights operating under the peacetime airborne reconnaissance program (PARPRO) continued unabated as did the evolution of airborne SIGINT aircraft.

Though the Sun Valley C-130A-II was a major improvement over the RB-50, it remained a slow aircraft with limited range and equipment space. To bring airborne SIGINT collection into the jet age, the USAF needed a large, long-range aircraft that it could easily modify. The search was a short one. In the mid-1950s, the USAF had purchased the B-707 from Boeing and had begun producing KC-135 air refuelers and C-135 transport aircraft.[130] Aircraft engineers and systems designers quickly determined the B-707 platform as suitable for modification. In approximately 1961, Big Safari began the first conversion of the B-707 to the RC-135A and by 1962, SAC was flying the RC-135 as part of the worldwide PARPRO.

During the 1960s and 1970s, the USAF modified the RC-135 multiple times and created several mission-specific variants which are all still in use today. In late 1964, the RC-135U Combat Sent made its first appearance. Heavily modified to collect strategic ELINT, the Combat Sent quickly became crucial in the United States' understanding of the ELINT environment.[131] Data collected during its sorties directly led to the enhancement of techniques which allow American forces to evade and defeat hostile systems. In March 1972, the USAF deployed the RC-135S Cobra Ball to collect optical and electronic data on missile launch events.[132] The Cobra Ball has become a mainstay in the observation of missile launches worldwide and is one of the most heavily deployed assets in the USAF inventory.

The RC-135 V/W remains the crown jewel of the RC-135 fleet,

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[130] Swanborough, *United States Military Aircraft*, 147.
[131] For further information on the RC-135U, see the USAF's official factsheet available online at: http://www.af.mil/information/factsheets/factsheet.asp?fsID=191.
[132] For further information on the RC-135S, see the USAF's official factsheet available online at: http://www.af.mil/information/factsheets/factsheet.asp?fsID=19191.

however. The result of a long series of capability upgrades and refinements, the RC-135 V/W has been involved in every major contingency since its first deployment in Vietnam.[133] Each upgrade to the aircraft has increased its ability to collect intelligence and, importantly, its ability to communicate with customers in near real-time. The state-of-the-art capability of the RC-135 V/W often makes it the first American aircraft to arrive in areas of conflict and, more often than not, also makes it the last to leave – as a continual presence in the Persian Gulf since 1990 attests.

Like most reconnaissance aircraft, the RC-135 operated without any fanfare until an unfortunate incident revealed it to the world. On 1 September 1983, the USSR shot down a Korean Air Lines flight near the Soviet island of Sukhalin claiming it was an American reconnaissance platform.[134] To refute the claim, the United States admitted there had been an RC-135S Cobra Ball aircraft operating near the Kamchatka Peninsula earlier in the day, but that it had returned to base long before the shoot down.[135] The very admission of the existence of the RC-135 was a deviation from standard procedure. Since that time, the USAF has been relatively open regarding the RC-135's various missions but still does not reveal details about its collection capabilities.

With the U-2 and the RC-135, the USAF capped an exciting period in the evolution of airborne ISR. Growing from a nascent capability at the end of the Second World War, airborne intelligence collection had taken its rightful place as a flexible provider of strategic intelligence. Faced with a dearth of information regarding Soviet targets, USAF planners undertook a crash effort to build capabilities that would provide them the detailed information they needed to conduct strategic air warfare. Modified aircraft – B-17s, B-24s, and C-47s – were the first to

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[133] For further information on the RC-135 V/W, see the USAF's official factsheet available at: http://www.af.mil/information/factsheets/factsheet.asp?fsID=121.
[134] Van der Aart, *Aerial Espionage*, 88.
[135] Seymour Hersh, *The Target is Destroyed* (New York, NY: Random House, 1986), 156.

get involved. Their photomapping of Europe and North Africa set the precedent for future airborne IMINT missions in Alaska.

SAC's war planners also relied heavily on airborne ELINT collection. Lacking information regarding Soviet air defense systems, SAC configured existing airframes for ELINT collection. Flying dangerously close to the USSR, these initial sorties provided strategic war planners with information on the extent of Soviet defenses along the Arctic approaches. Peripheral intelligence was important, but was not sufficient to plan air strikes within the USSR. Direct overflight was needed and in 1948, the USAF began its long history of penetrating Soviet territory when it flew its first F-13A sortie deep into Siberia. Though Presidential approval would wax and wane, deep penetration of Soviet airspace continued through the U-2 shoot down in May 1960.[136]

Strategic airborne COMINT collection also came of age during this period. Using a modified B-29 airframe, airborne linguists quickly proved their worth flying Russian intercept missions in the Sea of Japan and over Korea. Their success led to the USAF institutionalization of airborne COMINT as a fundamental necessity and in 1957, the C-130A-II became the USAF's first purpose-built COMINT platform. Rapid evolution over the next decade resulted in the RC-135 – a platform still used today.

During the Cold War, using ISR aircraft to collect strategic intelligence became a core requirement to understanding the Soviet military. Peripheral and direct overflight missions provided the intelligence the United States needed to remain one step ahead of the Soviets. Strategic intelligence collection – while incredibly dangerous – is not typically characterized by a sense of urgency, however. Strategic intelligence contributes to an overall understanding of the enemy and is

[136] While acknowledged American overflight ceased in 1960, the danger to ISR flights along the USSR periphery did not wane. In all, the Soviets downed at least 20 American ISR aircraft during the Cold War. For further information see Burrows, *By Any Means Necessary* and Tart, *Price of Vigilance.*

not considered time-sensitive. There were occasions, however, in which the USAF used its strategic airborne ISR platforms to provide direct support to ground commanders. These situations provided challenges to the strategic airborne ISR community as the information collected often meant life or death for troops on the ground and other airmen in the skies. In Korea, Vietnam, and Iraq, airborne ISR airmen would develop innovative ways to ensure their intelligence reached the warfighter. Their efforts would prove that airborne ISR assets could satisfactorily fill both roles – strategic and tactical.

Chapter 6

Tactical Airborne ISR – Direct Support to the Warfighter

Many intelligence reports in war are contradictory; even more are false, and most are uncertain.

Carl von Clausewitz

Before satellite-derived intelligence became widespread, airborne ISR assets provided the United States with the preponderance of its intelligence information on the USSR. Throughout the Cold War, American reconnaissance platforms conducted dangerous – and often deadly – missions over the USSR and along its periphery. The existential threat posed by the Soviets made obtaining information on it the top Cold War priority for the American intelligence community. The evolution of ISR aircraft mirrored the concentration on the USSR. Beginning with leftover bombers from World War II, airborne ISR aircraft underwent a rapid transformation. The B-17, B-24, B-29, F-13, RB-36D, RB-45C, RB-50, and C-130A-II paved the way for the ISR force that reached a high level of effectiveness in the latter half of the Cold War.

The almost exclusive focus on the USSR, however, created significant deficiencies in the United States' ability to provide intelligence on other targets. When America became involved in conflicts outside of a direct superpower confrontation, the intelligence community struggled to provide the information needed by strategic and tactical decision-makers. A lack of linguists, analysts, equipment, and aircraft would stymie United States intelligence agencies in the early stages of these limited war scenarios. In each, however, airborne ISR would evolve – aircraft would be modified, equipment found, linguists and analysts reassigned. Within a short time following the outbreak of hostilities, ISR airmen would show their flexibility and become key contributors.

The singular Soviet focus also had ramifications for the timeliness with which airborne ISR intelligence flowed. The strategic nature of the information gathered from flights against the Soviets generally meant that analysts had ample time to review the information they collected before disseminating any intelligence. While the information was highly important, life and death decisions did not typically rely on the timely delivery of airborne-derived intelligence.[1] In tactical situations, where the information collected by airborne assets can mean life or death for a pilot or ground troop, ISR airmen are not provided the luxury of time. Immediate dissemination of intelligence gleaned from the collected information is paramount. With its focus on the USSR throughout the Cold War, the airborne intelligence community was not postured to develop rapid intelligence to the warfighter during the proxy wars of the 1950s, 1960s, and 1970s.

Security restrictions further hampered the airborne ISR community's ability to provide direct intelligence to air and ground forces. While IMINT was readily shared, SIGINT information remained buried behind multiple levels of classification. As will be seen, to bypass the security firewalls, intelligence professionals instituted shrewd workarounds designed to disguise the sources of the intelligence.

Despite these roadblocks – singular focus on the USSR, inability to deliver timely, accurate intelligence, and stifling security constraints – ISR airmen were able to make significant contributions. In the three cases on which this chapter will focus – the Korean War, the Vietnam War, and Operation Desert Storm – airborne ISR forces responded to the challenges and became integral parts of the decision cycle. Their role in these conflicts would solidify airborne ISR's standing as a core competency of joint warfighting.

Korean War

[1] The Cuban Missile Crisis is, of course, a major exception to this.

When North Korea invaded the south in June 1950, American intelligence was woefully unprepared to provide ground and air commanders with the support they needed. Lack of linguists, photo interpreters, equipment, and aircraft all contributed to the dearth of information in the early stages of the conflict. This intelligence shortfall would contribute directly to the early misapplication of airpower and to the many tactical miscalculations made by ground commanders.[2] As the war progressed, however, airborne ISR evolved. Dedicated airmen cobbled together a competent tactical IMINT capability despite the USAF's hesitancy to divert USSR-focused assets. Additionally, airmen of the USAFSS created a system to provide airborne COMINT directly to the cockpits of fighters and bombers, providing them with unprecedented situational awareness. These successes in Korea would lay the groundwork for airborne ISR integration in subsequent conflicts.

Following World War II, America rapidly demobilized. Hard-learned intelligence skills gained in the war atrophied and airborne ISR advanced little. With Japan utterly defeated, scant attention was paid to developments in Asia. To say the North Korean invasion of South Korea came as a shock would be a serious understatement. Indeed, Korea was not even in General Douglas MacArthur's area of responsibility as the Truman Administration had left it out of its Far East defense line.[3] Additionally, nearly all US forces had withdrawn from the Korean peninsula following the election of Syngman Rhee.[4] Korea had been split between the Communists in the north and the American-backed democracy in the south. With MacArthur's thoughts focused on rebuilding Japan and the intelligence community's emphasis on the

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[2] Early misapplication of airpower included the decision to conduct a strategic bombing campaign against North Korea's industrial base while tactical errors on the ground included Douglas MacArthur's decision to move his forces into North Korea following the Inchon landings.
[3] Stanley Sandler, *The Korean War: No Victors, No Vanquished* (Lexington, KY: University Press of Kentuck, 1999), 28.
[4] Ibid., 28, 42.

USSR, it is no surprise that the United States was caught flat-footed when the North Koreans invaded on 25 June 1950.

When the war began, USAF intelligence assets in the Far East were meager and airmen were not included in MacArthur's inner circle.[5] Far East Air Forces (FEAF) – MacArthur's major air force command – maintained a paltry intelligence staff of 98 officers at its headquarters in Tokyo.[6] Of the 98, only 30 percent had formal intelligence training, while the rest had either no training or under two years' intelligence experience.[7] Units in the field were equally sparse and underequipped. Fifth Air Force – FEAF's warfighting command – had only one tactical IMINT squadron to go along with two strategic IMINT squadrons.[8] While the tactical squadron – the 8th Tactical Reconnaissance Squadron (TRS)[9] – had the RF-80A (a first-generation jet), the other organizations – the 31st Strategic Reconnaissance Squadron (SRS) and the 6204th Photo Mapping Flight (PMF)[10] – were flying antiquated Boeing RB-29s and RB-17s respectively.[11] Additionally, there was only one FEAF squadron capable of conducting photo interpretation and analysis – the 548th Reconnaissance Technical Squadron (RTS).[12] As the 548th RTS was located at Yokota Air Base (AB), Japan, any imagery taken over Korea would have to be flown back to Japan for interpretation before it could be

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[5] MacArthur's intelligence staff was dominated by his G-2, Major General Charles Willoughby. Additionally, only one USAF intelligence officer served within the G-2 staff. Charles P. Cabell, *A Man of Intelligence: Memoirs of War, Peace, and the CIA* (Colorado Springs, CO: Impavide Publications, 1997), 260.

[6] Gordon L. Rottman, *Korean War Order of Battle: United States, United Nations, and Communist Ground, Naval, and Air Forces, 1950-1953* (Westport, CT: Praeger Publishing, 2002), 73.

[7] Robert F. Futrell, "A Case Study: USAF Intelligence in the Korean War," in *The Intelligence Revolution: A Historical Perspective, Proceedings of the Thirteenth Military History Symposium.* Edited by Lt. Col. Walter T. Hitchcock (Washington, DC: Office of Air Force History, 1991), 279.

[8] Ibid.

[9] Robert F. Futrell, *The United States Air Force in Korea* (Washington, DC: Office of Air Force History, 1996), 545.

[10] Ibid.

[11] Futrell, *USAF Intelligence in the Korean War*, 279.

[12] History, 548th Reconnaissance Technical Squadron, 1 June-31 October 1950, 1, K-SQ-RCN-548-HI (TECH), AFHRA.

disseminated to the customer.

FEAF's SIGINT capability was in even worse condition. In June 1950, the USAFSS' 1st Radio Squadron Mobile (RSM) was the only operational SIGINT unit under FEAF's control and it did not possess an airborne collection capability.[13] Additionally, the unit was only authorized 11 officers and 243 enlisted men.[14] In an internal report, USAFSS characterized its SIGINT capabilities at the outbreak of war as "pitifully small and concentrated in the wrong places."[15]

All four of FEAF's intelligence units – as did most others in the Far East – focused exclusively on the USSR with particular emphasis on military, naval and industrial activities in Siberia.[16] Understandably, the threat posed to the United States by the Soviets warranted this focus. Even as the war in Korea progressed and the need for additional airpower became apparent, however, USAF leaders – particularly General Curtis LeMay – were reluctant to release air assets to Korea.[17] Eventually commanders in Korea would get airborne ISR. In June 1950, however, a Joint Chiefs of Staff report summarized the entirety of the intelligence community's ability to provide Korean intelligence in peacetime as "far short" of what was needed and further stated that the available resources were incapable of handling the vastly greater requirements of war.[18]

Immediately upon the outbreak of the conflict, Fifth Air Force began seeking ways to improve its tactical IMINT capability. By October 1950, the USAF had increased the strength of the 8th TRS from 17 to 30 RF-80As, the 31st SRS had moved its RB-29s from Travis Air Force Base

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[13] History, 1st Radio Squadron Mobile, 1 August 1949-30 April 1950, 160.032-76, AFHRA.

[14] Larry Tart and Robert Keefe, *The Price of Vigilance: Attacks on American Surveillance Flights* (New York, NY: Ballantine Books, 2001), 154.

[15] Headquarters USAFSS, *A Special Study: Securing Air Force Communications, 1948-1958*, vol I, 1 April 1966, 37.

[16] History, History of FEAF, January-June 1950, 71, 720.01 V.1, AFHRA.

[17] Conrad Crane, *American Airpower Strategy in Korea, 1950-1953* (Lawrence, KS: The University Press of Kansas, 2000), 26.

[18] JCS 86211, DEPTAR (JCS) Washington DC to CINCFE Tokyo, Japan, 10 March 1951, Radiograms, JCS, 30 June 1950 - 5 April 1951, RG 9, Box 43, NARA.

(AFB), California, to Johnson AB, Japan, and the 6204th PMF had moved its B-17s from Clark AB, Philippines, to Johnson AB.[19] Shifting existing resources was not Fifth Air Force's only improvement mechanism. By the end of September, the 162nd TRS, the 45th TRS, and the 363rd RTS had joined the others in Japan.[20] Additionally, on 26 September, the Fifth Air Force activated the 543rd Tactical Support Group (TSG) to oversee all tactical IMINT operations.[21]

Additional organizations and aircraft were critical, but FEAF also needed experienced personnel. In January 1951, Lieutenant General George Stratemeyer, FEAF Commander, petitioned the USAF for Colonel Karl "Pop" Polifka.[22] Polifka had commanded the Mediterranean Allied Photographic Reconnaissance Wing (MAPRW) in World War II and was considered one of USAF's foremost experts on tactical airborne IMINT.[23] Upon arrival, he was attached to the 543rd TSG in an advisory capacity.

Within days of his arrival, Polifka began forging improvements to the efficiency of FEAF's tactical IMINT operations. His first objective was to establish a method to deconflict target requests from the various FEAF customers. To accomplish this, Polifka instituted a ledger system that tracked all tactical IMINT sorties and the status of the imagery interpretation from each.[24] This allowed his photo interpreters to prioritize their efforts and deliver intelligence much more proficiently.

Polifka had such success that when FEAF determined a reorganization of its tactical IMINT units was required, Stratemeyer

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[19] Futrell, *USAF Intelligence in the Korean War*, 282; Judy G. Endicott, *USAF Organizations in Korea, 1950-1953*, 71, AFHRA, available online at: http://www.afhra.af.mil/shared/media/document/AFD-090611-102.pdf (accessed 22 March 2012).
[20] Futrell, *The U.S. Air Force in Korea*, 546.
[21] History, 543rd Tactical Control Group, 26 September-31 October 1950, K-GP-RCN-543-HI, AFHRA.
[22] Futrell, *The U.S. Air Force in Korea*, 546.
[23] Robert C. Ehrhart, "The European Theater of Operations, 1943-1945," in *Piercing the Fog: Intelligence and Army Air Forces Operations in World War II*, ed. John F. Kries (Washington, DC: Air Force History and Museums Program, 1996), 180.
[24] History, History of Fifth Air Force, 1 January-30 June 1951, vol II, *Operations*, 337, K730.01 V2, AFHRA.

selected Polifka as the new wing commander. On 25 February 1951, FEAF activated the 67th Tactical Reconnaissance Wing (TRW) to oversee all tactical IMINT missions over Korea.[25] The establishment of the wing resulted in the resubordination of many of the FEAF units. Upon establishment, the 67th TRW had the following units: the 67th Group (formerly the 543rd TSG), 12th TRS (formerly the 162nd TRS), the 15th Tactical Reconnaissance Squadron (formerly the 8th TRS), the 45th TRS, and the 363rd RTS.[26] In August, the geographically separated units all relocated to Kimpo Airfield near Seoul giving the 67th TRW enhanced control of its units and greatly contributing to the wing's ability to meet the theater's heavy tactical IMINT demands.[27] Prior to the move, raw imagery was flown from the collecting units to the 548th RTS at Yokota or to its detachment in the Philippines before being disseminated to the customer.[28] After the move, all tactical IMINT sorties returned to Kimpo where the imagery was read out as quickly as possible, and was then disseminated.

While the 67th TRW expanded its units and aircraft inventory, it still faced a significant shortfall in photo interpreters and analysts. Complicating the issue was the lack of United States Army (USA) photo interpreters. In an agreement between the USAF and USA, the USA was obligated to manage the interpretation and reproduction of photography it obtained from the USAF.[29] Unfortunately, the Army's intelligence capability was also in disarray at the beginning of conflict. Eighth Army was aware of the obligation to process its own imagery, but it was simply unable to meet the requirement due to a lack of personnel.[30] Thus, until

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[25] History, 67th Tactical Reconnaissance Wing, 25 February-30 June 1951, K-WG-67-HI, AFHRA.
[26] Futrell, *The U.S. Air Force in Korea*, 546-547.
[27] Ibid., 547.
[28] Glenn B. Infield, *Unarmed and Unafraid* (New York, NY: The Macmillan Company, 1970), 136.
[29] *Joint Training Directive for Air-Ground Operations*, Prepared jointly by US Army, Chief, Field Forces, and US Air Force Tactical Air Command, 1 September 1950, 169-174.
[30] Futrell, *The U.S. Air Force in Korea*, 548.

February 1951, the 363rd RTS processed all tactical imagery for the USA.[31] This severely hamstrung both services' ability to take full advantage of the growing tactical IMINT capability as there was many more images taken each day than the USAF's photo interpreters could analyze.

Fortunately, the consolidation of the 67th TRW at Kimpo had improved the wing's ability to satisfy customer requirements. Before his death during an operational sortie in July 1951, Polifka had normalized the entire IMINT process from requirements through dissemination. Requests for imagery from units all over Korea were funneled up through Fifth Air Force, who approved or disapproved the targets, and then sent them to the 67th TRW for execution. Based on their urgency, targets were either placed in a queue for immediate prosecution or were added to an established target deck that was systematically serviced by the various units within the 67th TRW. In a time before integrated communication networks, the co-location of the wing's units greatly facilitated its ability to rapidly distribute the imagery tasking. Additionally, the wing established a mechanism whereby field units could request time-sensitive imagery directly from the 67th TRW itself. Dissemination was challenging as all images were hard-copy only, but the 67th established an adequate courier network to deliver the imagery almost immediately after it was interpreted.

While the above efforts solidified the USAF's ability to provide tactical airborne ISR directly to the warfighter, where the 67th TRW significantly distinguished itself was in the establishment of a system it called "Hammer." In Hammer operations, North American RF-51Ds flown by the 45th TRS patrolled sectors extending 15 to 20 miles forward

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[31] History, 363rd Reconnaissance Technical Squadron, 1 January-28 February 1951, K-SQ-RCN-363-HI (TECH), AFHRA.

of each army corps' area of responsibility.[32] As the pilots flew these areas repetitively, they were able to almost immediately detect any new enemy forces present in their observation areas. The pilots communicated the changes directly to the corps fire-support coordination centers and also directed friendly fighter-bomber strikes against the targets they located.[33] The 45th TRS' pilots were the eyes of the ground force much like remotely piloted aircraft (RPA) with their full-motion video (FMV) capability have become today. Today, FMV is streamed directly to the warfighter; in Korea, the 45th's pilots made up for the lack of technology with their target expertise. They were able to identify targets for the Army's artillery batteries along with the coalition's fighter-bombers and close air support (CAS) aircraft. Radio communications allowed airborne ISR aircraft to communicate in real-time directly with attack assets. Technology had finally caught up with Foulois' dream of so long ago.

Throughout the remainder of the war, FEAF's tactical IMINT capabilities steadily increased with units receiving additional aircraft and personnel. In July 1952, the Army finally established the 98th Engineer Aerial Photo Reproduction Company, giving the Army the ability to meet its photo interpretation obligations.[34] From then through the armistice in July 1953, tactical IMINT exceeded all expectations. In scarcely over two years, the 67th TRW shattered all of the standards set by tactical IMINT units in World War II. From D-Day to V-E Day, the Ninth Air Force reconnaissance group averaged 604 sorties a month. In the same time period, from April 1952 through March 1953, the 67th TRW averaged 1,792. In the same timeframe, the photo interpreters that supported the Third Army in its drive across Europe made 243,175 photo

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[32] "Tactical Doctrine of the 45th Tactical Reconnaissance Squadron," 1 January 1952, K-SQ-RCN-45-SU-RE, AFHRA; History of Fifth Air Force, 1 January-30 June 1951, 345.
[33] Futrell, *The U.S. Air Force in Korea*, 547.
[34] Ibid., 552.

negatives, while the 67th TRW made 736,684.[35] Tactical IMINT had a major impact toward the United Nations' ability to secure an armistice and effectively end the conflict. As seen, it provided Army and USAF commanders with the information they needed to enable immediate fire operations and for future planning. Additionally, the 45th TRS had established the foundation for future CAS and forward air controller (FAC) missions.

While airborne IMINT collection was immediately improved following the outbreak of the war, airborne SIGINT was much slower to develop. In June 1950, FEAF's only operational SIGINT unit – the 1st RSM – was undermanned and focused on the USSR. As the war began, the squadron, and indeed the entire United States intelligence community, had no Korean linguists and limited access to North Korean COMINT.[36] To remedy the situation, the squadron sought first to improve its ground collection capability. By late November 1950, it had established collection detachments at Ashiya AB, in extreme southern Japan, and in Pyongyang, North Korea.[37] The airmen working in Korea would tally the squadron's first major contribution to the war.

As the initial surges of the ground war stabilized, FEAF increased its heavy bombing attacks on North Korean targets. With the additional sorties came a concomitant increase in B-29 shootdowns. As the 1st RSM's ground detachment was by this time collecting the communications of the Chinese People's Liberation Army Air Force (PLAAF) fighters, FEAF commanders pushed USAFSS to develop a system by which they could relay the enemy fighters' intent to their aircrews in near real-time. On 23 April 1951, Detachment 13 of the 1st RSM formed a team to provide what is now known as "advisory support" –

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[35] Ibid., 555.
[36] Thomas L. Burns, "The Origins of the National Security Agency: 1940-1952," in *United States Cryptologic History*, Series V, vol 1 (Fort Meade, MD: Center for Cryptologic History, 1990), 85.
[37] The latter was to arrive shortly before the main Chinese intervention and was forced to withdraw with the rest of the United Nations forces. Tart, *Price of Vigilance*, 155.

communicating COMINT-derived information directly to warfighters in order to advise them of imminent attacks.[38] Team I – as the new organization was called – was collocated with the 606th Air Control and Warning Squadron (ACWS) whose responsibility was to provide command and control of all aircraft operating over Korea.[39] Team I collected COMINT concerning PLAAF and Korean People's Army Air Force (KPAAF) fighter activity in the area of active American bombers and subsequently provided this information to the 606th ACWS' aircraft controllers. This allowed the controllers to warn the bombers of any impending enemy attacks and to also direct friendly fighters to intercept the PLAAF and KPAAF Mikoyan-Gurevich MiG-15s.[40] In a testament to the effectiveness of this relationship, in a single air engagement on 27 November 1951, American F-86 pilots – armed with the COMINT information from Team I – killed 11 MiG-15s while suffering no friendly casualties.[41]

In another example of the success of advanced warning, on 30 November, Team I detected a large force of PLAAF aircraft taking-off from an air base in Manchuria heading for Taehwa-Do Island in the Yellow Sea.[42] Team I passed the information to the 606th ACWS controllers who vectored a group of 31 North American F-86 Super Sabre fighters to intercept the PLAAF force. When it arrived at the location provided by Team I, the group of Sabres encountered a force of 12 TU-2 bombers, 16 LA-9 fighters, and 16 MiG-15s.[43] With the advantage of surprise on their side, the Sabres decimated the PLAAF force shooting down eight of the TU-2s, three LA-9s, and one of the MiG-15s with only one of the Sabres

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[38] History, *History of the US Air Force Security Service, January 1, 1951-June 30, 1951*, part II, 514-515 (obtained via FOIA request).
[39] History, 606th Air Control and Warning Squadron, 1 January-30 June 1951, K-SQ-AW-606-HI, AFHRA.
[40] *History of the US Air Force Security Service*, 515.
[41] Tart, *Price of Vigilance*, 156.
[42] *A Special Historical Study of USAFSS Response to World Crises, 1949-1969*, 7, 22 April 1970 (obtained via FOIA request).
[43] Futrell, *The U.S. Air Force in Korea*, 415.

receiving damage.[44] Lieutenant General Otto P. Weyland, FEAF Commander, was extremely impressed with the results, calling the incident "highly gratifying."[45]

The success of Team I was to be short lived. Its intercepts were all in the high frequency (HF) radio spectrum which was used by the PLAAF MiG-15s. HF waves travel a long distance and Team I was able to intercept PLAAF activity occurring almost anywhere in the Far East. This all began to change in the fall and winter of 1950, however. In as early as October, the Chinese began receiving the upgraded MiG-15bis from the Soviets.[46] Along with the enhanced speed and maneuverability, the MiG-15bis used a very high frequency (VHF) radio for communications.[47] With the introduction of the new MiG, Team I lost its ability to collect tactical COMINT from its location at Kimpo Airfield. As more and more MiG-15bis entered service, it became imperative for the USAFSS to identify a location closer to North Korea from which it could intercept the new VHF communications.

In May 1952, Detachment 153 of the newly arrived 15th RSM commenced COMINT operations on Cho Do Island located off the northeast coast of South Korea. This location provided the linguists of the 15th RSM with access to the majority of the new Chinese VHF communications. In addition to Detachment 153, FEAF colocated a detachment of the 606th ACWS in an attempt to replicate the highly successful operations that had occurred at Kimpo between Team I and the 606th.[48] The results were significant. Interception of the MiG-15 traffic along with additional collection of the enemy air radar network

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[44] Ibid.
[45] History, 4th Fighter-Interceptor Wing, 1 November-30 November 1951, K-WG-4-HI, AFHRA.
[46] Robert F. Dorr and Warren Thompson, *The Korean Air War* (Osceola, WI: Motorbooks International, 1994), 94.
[47] Tart, *Price of Vigilance*, 194.
[48] *Historical Data Report for the 6920th Security Group: April 1, 1952-June 30, 1952,* Annex A, 3-4 (obtained via FOIA request).

provided Detachment 153 linguists with an accurate reflection of the enemy's air picture.[49] Through a cleverly designed system recommended by Captain Delmar Lang, Detachment 153 circumvented the prohibitions on sharing COMINT data with non-cleared personnel.[50] By combining the raw COMINT data with the radar information they were already receiving, the 606th's ground-controlled intercept (GCI) operators were able to vector aircraft to set ambushes on arriving MiGs and to advise friendly bombers of safe infiltration routes.[51] These operations continued throughout the conflict with great success. While history often attributes the lopsided F-86 to MiG-15 kill ratio to superior American pilots and aircraft, it is indubitable that the efforts of the 1st and 15th RSMs were major factors. Unfortunately, when most official histories were compiled, the activities of the USAFSS organizations were still highly classified. Nevertheless, the airmen of these organizations received recognition from their superiors with Generals Stratemeyer and Weyland decorating the units.[52]

While USAFSS ground collection was developing, a concurrent effort was underway to extend the range of COMINT collection through airborne COMINT flights. As they had in World War II, airmen first began flying as "tag-a-longs" on non-ISR aircraft. In as early as January 1951, Unit 4 of the 21st Troop Carrier Squadron was flying deep-penetrating, low-level missions into North Korean territory. Their primary mission was the infiltration of friendly spies, but these Douglas C-47 sorties often carried a linguist to provide advisory support to the

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[49] Tart, *The Price of Vigilance*, 195.
[50] National Security Agency, "Delmar C. Lang: A SIGINT Innovator," *Cryptologic Almanac 50th Anniversary Series*, available online at: http://www.nsa.gov/public_info/_files/crypto_almanac_50th/Delmar%20C%20Lang.pdf (accessed 27 March 2010).
[51] For further information on the system – known as "Plot-Tell Reporting" see Larry Tart, *Freedom Through Vigilance: USAFSS Ground Sites in Alaska and the Far East*, vol. III (West Conshohocken, PA: Infinity Publishing, 2010), 1327.
[52] Department of the Air Force General Order No. 36, 13 October 1954, contained in *Historical Report, 15th Radio Squadron, Mobile, 1 August-31 December 1954*, 91, RG 457, NARA.

mission aircraft – much like the missions in World War II – and to support Fifth Air Force intelligence requirements.[53] In January 1951 alone, the unit is known to have flown as many as 13 sorties where "radio intercept" was listed as the primary mission.[54] These forays deep behind enemy lines gave the FEAF unprecedented understanding of the enemy situation and contributed significantly to the Fifth Air Force's air planning effort.[55]

In another attempt to provide intelligence directly to the warfighter, in February 1953, the USAFSS installed a COMINT collection position on a C-47 airborne Tactical Air Control Center (TACC) operated by the 6147th Tactical Control Group (TCG).[56] First utilized as a communications relay positioned between front line aircraft and the TACC at Kimpo, the airborne C-47 quickly became a command and control platform in its own right.[57] In the beginning, "Mosquito Mellow," as it became known, passed messages between tactical air control parties (TACP), airborne controllers, fighter-bombers, and the "Mellow" station of the TACC.[58] Over time, however, the aircraft's ability to shorten the communications chain between tactical aircraft and the TACC led it to become the de facto TACC. Due to the same security restraints that had limited Detachment 153's ability to provide raw COMINT directly to the 606th, the USAFSS COMINT position on the "Mellow" aircraft did not directly increase the C-47 crew's situational awareness. However, USAFSS installed a secure communication method that allowed the linguist to communicate directly with Detachment 153. Upon receipt of

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[53] Warren A. Trest, *Air Commando One: Heinie Aderholt and America's Secret Air Wars* (Washington, DC: Smithsonian Institute Press, 2000), 34.
[54] Michael E. Haas, *Apollo's Warriors: United States Air Force Special Operations During the Cold War* (Maxwell AFB, AL: Air University Press, 1997), 26.
[55] Trest, *Air Commando One*, 42-43.
[56] History, 6147th Tactical Control Group, 1 January-30 June 1953, K-GP-TACT-6147-HI, AFHRA.
[57] James A. Farmer and M.J. Strumwasser, *The Evolution of the Airborne Forward Air Controller: An Analysis of Mosquito Operations in Korea* (Santa Monica, CA: The Rand Corporation, 1967), 37.
[58] Futrell, *The U.S. Air Force in Korea*, 343.

COMINT from the linguist on the "Mellow" aircraft, Detachment 153 personnel would alert the 606th ACWS. This information – now sanitized – was often sent back to the "Mellow." This intelligence often resulted in fighters, bombers, and ground forces being diverted from their primary missions to support emerging situations as detected by the airborne linguist.[59] In another foreshadowing of the future, these early airmen set a precedent that would ultimately become standard operating procedure among the RC-135, E-3A AWACS, and E-8 JSTARS aircraft. The three platforms often share sanitized intelligence information to enhance situational awareness and decision making.

The final effort by the USAFSS to provide additional airborne COMINT directly to the warfighter was in a project known as Blue Sky. Having solved the problem of the loss of MiG-15 HF communications, Major Leslie Bolstridge of the 6920th Security Group proposed the idea of equipping C-47s with COMINT collection equipment.[60] In late 1952, FEAF gave the group three C-47s and assigned them to the 6053rd Radio Flight Mobile at Yokota AB.[61] Operations commenced almost immediately and were a huge success. Operating over mainland Korea and the Sea of Japan, the newly outfitted RC-47 was able to provide unprecedented access to targets deep within North Korea and China.

Analysis of the unit's collection was an interesting endeavor. With limited ability to process the intelligence on the aircraft, the 6920th created a system in which the mission aircraft would jettison its tape recordings to waiting members of Detachment 153 on Cho Do Island. In a procedure that foreshadowed the CORONA imagery satellite's delivery mechanism, the RC-47's crew rigged parachutes on the recorded tapes and then released them over a designated area of beach on the island.[62]

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[59] Farmer, *The Evolution of the Airborne FAC,* 39.
[60] The 6920th Security Group was the USAFSS organization that oversaw the 1st and 15th RSM's operations in Korea.
[61] Tart, *The Price of Vigilance*, 196.
[62] Ibid., 198.

The tapes were then quickly taken to Detachment 153 where any pertinent intelligence was passed to the 606th ACWS controllers. While not as timely as direct threat warning would come to be, this method was useful and provided valuable intelligence. As proof of its value, when one of the squadron's RC-47s crashed during a takeoff from Yokota, FEAF commander General Weyland offered his own VIP C-47 as a replacement for the damaged aircraft.[63]

When the war began, airborne ISR was bereft of any significant capabilities. As it had in World War II, however, the USAF quickly built a competent airborne IMINT force. By the early months of 1951, tactical imagery collection was satisfying the majority of its customer's requirements. As the war progressed, tactical IMINT improved dramatically. The same can be said for airborne COMINT. Mostly neglected in the early stages of the war, airborne COMINT also evolved to become a major contributor to the success of both land and air power. More importantly, airmen developed procedures that allowed them to quickly communicate intelligence to both air and land commanders. For IMINT, it was a rapid courier method, but for COMINT, a sophisticated airborne system was developed that allowed warfighters to receive sanitized intelligence in near real-time. The impact of COMINT has never been truly explored, but it is certain that it significantly helped to win the battle for air superiority.

Vietnam War

As opposed to the build-up required in the Korean War, both airborne IMINT and COMINT entered the Vietnam conflict prepared to support tactical air and ground commanders. Indeed, airborne ISR assets were conducting operations in and around Vietnam long before the United States acknowledged its presence there. By early 1961, airmen of the USAFSS were flying their RC-47 Project Blue Sky COMINT

[63] Ibid., 197.

aircraft – then known as Project Rice Bowl – over Vietnam.[64] Additionally, airborne IMINT was one of the main missions of the first USAF airmen to see combat in Vietnam. When the Air Commandos of the 4400th Combat Crew Training Squadron (CCTS) arrived in South Vietnam in November of 1961, they utilized their T-28 and B-26 aircraft to help determine Viet Cong and North Vietnamese Army (NVA) disposition of forces.[65] Traditional tactical reconnaissance (TACRECCE) was also involved at the initial stages. In early 1961, Tactical Air Command (TAC) deployed its SC-47 Skytrain IMINT-configured aircraft to photograph Pathet Lao and North Vietnamese positions in the Plain of Jars.[66]

Taking advantage of their early arrival, airborne ISR forces were able to provide substantial levels of intelligence to tactical warfighters throughout the war. By the time the major United States force build-up began in 1965, both airborne IMINT and SIGINT assets had established mechanisms that would ensure the timely delivery of intelligence. For IMINT, the system was similar to the one established by "Pop" Polifka in the Korean War with requests for imagery being validated by United States Pacific Air Forces (PACAF) before they were tasked to the individual collection platforms. Dissemination also worked in a similar fashion to the Korean War. 7th Air Force – the USAF warfighting organization in Vietnam – established imagery processing units at all its main bases. After the imagery was read out, it was delivered by courier to the requesting unit. The availability of TACRECCE in Vietnam was unprecedented. According to USAF reports, during the nine-year war,

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[64] Robert J. Hanyok, "Spartans in Darkness: American SIGINT and the Indochina War, 1945-1975," in *The NSA Period: 1952 – Present*, series VI, vol 7, (Fort Meade, MD: Center for Cryptologic History, 2002), 242.
[65] Haas, *Apollo's Warriors*, 228.
[66] Craig C. Hannah, *Striving for Air Superiority: The Tactical Air Command in Vietnam* (College Station, TX: Texas A&M University Press, 2002), 8.

TACRECCE aircraft flew approximately 195,000 sorties.[67]

The lessons of the value of airborne COMINT were also remembered. The need to deliver sanitized COMINT directly to the warfighter had clearly been established in the successful operations of USAFSS' Detachments 13 and 153 during the Korean War. As the American presence in Vietnam began to increase in 1965, USAFSS planners sought to replicate their success. In April 1965, the USAF began flying the EC-121D Super Constellation as a command and control, early warning aircraft.[68] Almost immediately upon its arrival in theater, the USAFSS began equipping the platform with a COMINT intercept suite in a program called College Eye.[69] By 1967, the USAF had modified all EC-121Ds and USAFSS airmen onboard were providing near-real-time support to both USAF and United States Navy (USN) aircraft operating over Vietnam.[70]

In another attempt to get intelligence directly to the warfighter, American forces in Vietnam established the first automated tactical data links. Building on the College Eye program, PACAF planners initiated Operation Combat Lightning.[71] In a memorandum to then Secretary of the Air Force, Harold Brown, 7th Air Force Commander, Lieutenant General William Momyer, described the project as being "designed to interface a number of automated subsystems to give me a near real-time command and control capability…"[72] The idea was to link all tactical

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[67] Herman L. Gilster, *The Air War in Southeast Asia: Case Studies of Selected Campaigns* (Maxwell AFB, AL: Air University Press, 1993), 5.
[68] Major Paul Burbage et. al., "The Battle for the Skies Over North Vietnam," in *Air War-Vietnam* (New York, NY: Arno Press, 1978), 230.
[69] Tart, *Freedom Through Vigilance*, 1459.
[70] USAF Tactical Fighter Weapons Center, *Project Red Baron II: Air to Air Encounters in Southeast Asia*, vol. II, part 1 (Nellis AFB, NV: USAF Tactical Fighter Weapons Center, 1973), D-1, K160.0311-20 V. 2, PT. 2, AFHRA.
[71] "Combat Lightning (Fusion)," HQ USAF and PACAF Files, 3, K143.5072-4, AFHRA.
[72] General William W. Momyer, Commander, Seventh Air Force, to Harold Brown, Secretary of the Air Force, memorandum, 1 May 1968, K143.5072, AFHRA.

systems in theater together via one data link that all could receive.[73] Airborne systems – particularly the College Eye EC-121Ds – fed COMINT, fused with radar data, into the Combat Lightning system. Though classification problems prevented Combat Lightning from achieving much success, it did provide a real-time exchange of tactical information for the first time and set the precedent for post-war efforts to improve overall situational awareness.[74]

With the initiation of Linebacker operations in 1972, the USAF suffered increased aircraft attrition rates. During the nearly three year hiatus between the end of Rolling Thunder and the beginning of Linebacker, the North Vietnamese had greatly improved their air defense network. By 1972, over two hundred air surveillance and fire control radars were operating in North Vietnamese airspace.[75] Additionally, more capable MiG-21 and Chinese F-6 aircraft continued to arrive.[76] These additions to the North Vietnamese air defenses provided a rude awakening to American aircrews in the early stages of Linebacker. During June 1972 alone, the USAF lost 12 aircraft over North Vietnam and the USN nine. Seven of the American losses were to MiGs, while the USAF and USN had only downed two of the enemy's fighters.[77] American pilots were discouraged by the losses and sought improved situational awareness. The direct threat warning system in Korea had provided them with precise intelligence on the location of enemy aircraft; they wanted the same thing in Vietnam.

In response to his pilots' pleas, the 7th Air Force Commander, General John Vogt, sent a letter to the Chief of Staff of the Air Force, John Ryan. In the letter, Vogt stated his analysis showed that the USAF

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[73] Frank M. Machovec, "Southeast Asia Tactical Data Systems Interface," Project Checo Report, 1 January 1975, Checo/Corona Harvest Division, Operations Analysis Office, HQ PACAF, xi.
[74] Ibid., 5.
[75] Hanyok, "Spartans in Darkness," 269.
[76] Ibid., 270.
[77] John T. Smith, *The Linebacker Raids* (London, UK: Arms & Armour Press, 1998), 88.

was losing the air-to-air war.[78] Vogt asked Ryan if he could get the National Security Agency (NSA) to improve their support to him.[79] Ryan took immediate action. He first called the Director of the NSA, Vice Admiral Noel Gayler, and read Vogt's message to him.[80] Gayler replied that he believed they could improve their support and appointed Colonel Doyle Larson – then acting as the NSA representative to the Pentagon – as the project lead.[81] Doyle made immediate contact with General Ryan and was directed to establish an action team in the Air Staff's Quick Reaction Group. Doyle's team – which included Korean War COMINT veteran Delmar Lang – quickly set about brainstorming potential ways to get SIGINT directly to the cockpits.

Doyle's team agreed that the RC-135M Combat Apple was the most capable platform available, but the aircraft did not have the necessary communications capacity to pass information to the pilots.[82] Concluding the RC-135M would not be able to solve the immediate problem, the team next examined the U-2. U-2 flights over Laos were providing strategic IMINT, but were also equipped with a COMINT capability that could easily intercept the air activity over North Vietnam.[83] As the U-2 was already downlinking its COMINT collection to a van at Nakhon Phanom Royal Thai Air Force Base in Thailand, Doyle's team decided the best way to pass the COMINT was to set up a command and control van next to the U-2 exploitation van.[84] Similar to the arrangement Lang had established in Korea, this new system would allow the command and control van to pass direct threat warning information to pilots within seconds of reception. The van controlling the U-2 downlink was known

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[78] Major General Doyle E. Larson, "Direct Intelligence Combat Support in Vietnam: Project Teaball," in *American Intelligence Journal* 15, no. 1, Spring/Summer 1994, 56.
[79] Major General Doyle E. Larson, "Project Teaball," unpublished notes, date unknown (obtained via FOIA request), 1.
[80] Ibid.
[81] Ibid.
[82] Ibid., 2.
[83] Ibid.
[84] Larson, "Direct Intelligence Combat Support," 57.

as the "Teaball Van." Doyle's team liked the name and the entire project became known as Project Teaball.

In subsequent weeks, both Generals Ryan and Vogt approved the project and directed its implementation. Upon arrival in theater, fearful of reliance solely on the U-2's COMINT, Doyle's team began to look for additional platforms that could contribute.[85] They revisited the RC-135M and discovered that it could pass its collection to the USAFSS' 6929th Security Squadron at Osan, Korea, who could then relay it to the Teaball van at Nakon Phanom via secure communications. Additionally, radar data from the EC-121s and USN radar picket ships was included. These multiple sources of information gave the Teaball operations center the most robust intelligence picture available. Having established the operating procedures for Teaball, the next step was to explain the concept to the customers.

To ensure pilot buy-in, the Chief of the QRG, Lt Col Bill Kirk – himself a pilot – briefed Teaball operations to all the 7th Air Force's pilots. Of course, he could not tell the aircrews all the details of the origination of Teaball's information, but he made sure that they all understood that the data would be accurate and that they were to believe it. On 26 July 1972, Project Teaball went into effect.[86] After an initial period of growing pains marked by communications problems, the project met with huge success.[87] As in Korea, American pilots now had the information they needed to avoid enemy air ambushes and to set up their own. Kirk's indoctrination of the pilots had been successful. Within weeks, pilots were contacting the Teaball Weapons Control Center before their sorties to ensure they would be able to receive Teaball-derived intelligence.[88] From a nearly 1:2 kill ratio before Teaball, the kill ratio skyrocketed to

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[85] Hanyok, "Spartans in Darkness," 273.
[86] Larson, "Direct Intelligence Combat Support," 57.
[87] Hanyok, "Spartans in Darkness," 274.
[88] Larson, "Direct Intelligence Combat Support," 58.

over 4:1.[89] Looking back on Teaball operations, General Vogt stated, "With the advent of Teaball, we dramatically reversed this [1oss-to-victory ratio]…during Linebacker we were shooting down the enemy at the rate of four to one…same airplane, same environment, same tactics; largely [the] difference [was] Teaball."[90]

Teaball had shown that SIGINT-derived information could be shared in near-real-time with unindoctrinated personnel. The establishment of the Teaball control van ensured the sensitive pieces of the information could be stripped away before the intelligence was passed to the warfighter. When combined with the College Eye program, SIGINT support to the tactical fight was robust. While Combat Lightning had failed due to classification complications, it set the precedent for the sharing of information among both intelligence and non-intelligence platforms. Following Vietnam, airborne ISR developers would advance these intelligence sharing concepts even further. By the time the nation faced its next major conflict in Operation Desert Storm, both tactical data links and the rapid communication of intelligence had vastly improved.

Operation Desert Storm

When hostilities began on 17 January 1991, Saddam Hussein's military faced an airborne ISR capability unlike any seen in history. The sheer number and capability of coalition airborne intelligence was incredible. While ground capabilities had atrophied following Vietnam, the ominous threat posed by the USSR ensured that airborne ISR assets continued to evolve. While the USAF's main ISR platforms – the RC-135 and the U-2 – had been in the inventory for decades, during the interwar years, the airborne ISR community worked diligently to improve the aircraft's ability to provide tactical support. Additionally, the United

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[89] Ibid.
[90] Quoted in Marshal L. Michel, *Clashes: Air Combat Over North Vietnam, 1965-1972* (Annapolis, MD: Naval Institute Press, 1997), 283.

States' TACRECCE capability had vastly increased. In Desert Storm, 24 USAF McDonnell Douglas RF-4C Phantom IIs were dedicated solely to TACRECCE, while the USN installed tactical imagery pods on many of its Grumman F-14 Tomcats.[91] The result was an unprecedented level of tactical support for the warfighter. Though much of what transpired remains classified, it is clear that the two main areas the American ISR community sought to improve were its tactical data links and its ability to communicate directly with the warfighter.

Beginning almost immediately after the termination of hostilities in Vietnam, the airborne ISR community tried to advance the Combat Lightning scheme. In 1975, the United States created the Joint Tactical Information Distribution System (JTIDS) to provide a "secure, jam-resistant digital information link."[92] The first JTIDS terminals were too large to install on most tactical platforms and by the late 1970s engineers began a program to reduce the size.[93] By 1989, a smaller version – called the Class 2 JTIDS terminal – had been created and installed on many tactical platforms.[94] Further attesting to the significance of the requirement, the total program costs by the time Operation Desert Shield began in August 1990 were $2 billion for development and $1.9 billion for production. When hostilities began in January 1991, the USAF – by using JTIDS – was able to replicate what the Teaball operation had done in Vietnam. The crews of the airborne SIGINT platforms injected sanitized COMINT into JTIDS. This information, amplified by air radar data from the Boeing E-3 Airborne Warning and Control System (AWACS) and ground radar data from the

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[91] Spencer Tucker, ed., *The Encyclopedia of Middle East Wars: The United States in the Persian Gulf, Afghanistan, and Iraq Conflicts* (Santa Barbara, CA: ABC-CLIO, 2010), 56-57.
[92] David C. Aronstein, et. al., *Advanced Tactical Fighter to F-22 Raptor: Origins of the 21st Century Air Dominance Fighter* (Reston, VA: American Institute of Aeronautics and Astronautics, 1998), 182.
[93] Myron Hura, *Interoperability: A Continuing Challenge in Coalition Air Operations* (Santa Monica, CA: Rand Corporation, 2000), 108.
[94] Aronstein, *Advanced Tactical Fighter*, 182.

Boeing E-8 Joint Surveillance Target Attack Radar System (JSTARS) gave the warfighters unprecedented situational awareness. Near real-time intelligence from these platforms provided updated targeting information, Iraqi Air Force activity, and hostile surface activity along with making significant contributions to search and rescue efforts for downed aircrews.[95] The effort to deliver intelligence to the warfighter, begun long ago with messages dropped from balloons or signaled with colored streamers, had finally been automated.

While JTIDS provided the ability to see the entire threat picture, during Desert Storm not all units were equipped with JTIDS terminals. Thus, the airborne ISR community also recognized that it needed another method to communicate its intelligence directly to those who needed it. During the interwar years, airborne ISR assets were equipped with a large number of communications suites. These radios ensured the ability to communicate threat warning via both secure and non-secure methods in near real-time directly to the warfighter. For the first time in war, information was transmitted from airborne ISR aircraft via tactical data link directly to the warfighter and to decision-makers. Anyone with a JTIDS terminal and proper clearance was able to receive the intelligence picture. From the tactical level all the way to the grand strategic level, everyone viewed the same intelligence at almost the same time.

What resulted is well known; coalition forces routed the Iraqi Army in less than 100 hours. The evolution of tactical airborne ISR was complete. Building on an almost nonexistent capability in 1950, in only 40 years tactical airborne ISR had become what the early visionaries desired. Improved platforms provided the long-duration sorties required to fully understand the enemy, electronic data links provided the ability

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[95] Major James P. Marshall, *Near-Real-Time Tactical Intelligence on the Battlefield*, Air Force Research Institute Research Report No. AU-ARI-92-6 (Maxwell AFB, AL: Air University Press, 1994), 43.

to seamlessly communicate the intelligence to the consumer, and enhanced radio communications gave the ability to pass news of imminent threats directly to those in harm's way. Direct support to the warfighter had finally become a reality.

Chapter 7

Conclusions, Lessons, and Implications

Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur.

Guilio Douhet

Conclusions

The effectiveness demonstrated by airborne ISR forces in Operation Desert Storm was the result of a hard-fought struggle that spanned over two hundred years. Growing from ground commanders' simple desire to obtain better intelligence, airborne ISR became an integral part of all major militaries. In the earliest stages, the airframe was the focus. Captive balloons – while a major enhancement over ground-based reconnaissance – were limited by their lack of mobility. Quickly realizing that their static nature restricted their utility and created vulnerabilities, designers endeavored to improve on the early designs. The result was the dirigible; however, concomitant anti-aircraft artillery improvements and the introduction of heavier-than-air flight doomed the dirigible to a short existence. As was its captive predecessor, the dirigible was too easy a target for modern air defenses.

Having gained primacy, the aircraft became the focus of airborne ISR improvement efforts and their resulting successes. ISR airmen in World War I were bound by the technology available; fanciful visions of what airborne ISR could do were restricted from becoming reality. As technology improved, so did airborne ISR. In World War II, airborne ISR began to provide intelligence that was unavailable via other means. Throughout the war, the British and Americans experimented with various types of airborne IMINT aircraft. First using modified bombers,

both nations realized the danger modern air defenses posed. To mitigate the dangers, first Britain, and then America, pursued high speed, high altitude aircraft to conduct airborne ISR. The resulting aircraft – the British Mosquito and the American F-4 – became the workhorses of the IMINT forces during the later stages of the war and set the high speed, high altitude precedent for the ultimate successors, the U-2 and SR-71.

Concurrent to the IMINT efforts, in 1940, the British BATDU conducted the first airborne ELINT collection mission in combat. This sortie – flown to collect the German homing beam that was enabling successful German night bombing of Great Britain – was a smashing success. The BATDU identified the parameters of the German signal and within weeks, the British had developed a jamming mechanism. In the United States, ELINT aircraft were also the first major airborne SIGINT contributors. In 1942, the USAAF modified a B-17 bomber, and flew the first American ELINT combat sortie. Though unsuccessful, this mission set the precedent for future ELINT development. The following year, a modified B-24 flying off the Aleutian Islands collected the first Japanese radar signal. In perhaps the first hint at the importance of airborne SIGINT collection, USAAF fighter-bombers immediately attacked and destroyed the Japanese radar. With these successes, the airborne ELINT program progressed rapidly. By 1943, multiple platforms were flying in the Mediterranean and the English Channel. These aircraft collected information on the German radar networks that revealed gaps in German air defense coverage. Using this information, invasion planners were able to plot infiltration routes that would give Allied invasions the best chance of success.

As the Germans retreated from Africa and Italy, ground-based COMINT collection suffered. In an attempt to extend their collection range, the British began placing linguists on their airborne ELINT missions. In October 1943, the Americans followed suit and by the invasion of Normandy, it was standard practice for a German linguist to

fly on bombing missions deep within Nazi-held Europe. The information the linguists were able to intercept – much like that of their fellow IMINT and ELINT brethren – was unique. The linguists developed a comprehensive understanding of German air tactics and built order of battle information that was unavailable from other sources. More importantly perhaps, the airborne linguists provided threat warning to the airborne crews. These warnings prevented countless deaths and indubitably contributed to Allied success.

With the conclusion of World War II, airborne ISR shifted its focus to the USSR. IMINT and SIGINT flights around the periphery of Soviet territory became common. While they provided desperately needed intelligence on Soviet air defenses, they were unable to penetrate deep within the country. A short-lived overflight program provided additional information, but until 1956, the United States had little information on the USSR. That all changed with the arrival of the U-2. Direct overflight of the USSR became possible. The perceived bomber gap was proven a myth; airborne ISR had provided another inimitable piece of intelligence. From the introduction of the U-2, the United States' strategic airborne IMINT capability was guaranteed. The follow-on SR-71 improved the capability, and never again would the USAF be without a dedicated strategic airborne ISR platform.

Airborne SIGINT also greatly evolved during the Cold War. From a rudimentary capability following the war where linguists still "piggybacked" on bombers, the USAF developed purpose-built SIGINT aircraft. In the early 1950s, with the introduction of the RB-50, USAF airborne SIGINT began its precipitous development. Within a decade, the RC-135 was in the inventory. Thus, by the early 1960s, the USAF had the backbone of its strategic airborne ISR capability already in place; the U-2 and the RC-135 remain to this day the primary components of that arsenal.

The above highlights the Cold War successes of strategic airborne ISR. There was also tremendous tactical success. During the Korean War, Vietnam War, and Operation Desert Storm, airborne ISR forces that had become accustomed to conducting only strategic collection were asked to provide tactical intelligence directly to air and ground warfighters. As this study has shown, airborne ISR airmen also succeeded mightily in these situations. In Korea, tactical IMINT and SIGINT kept ground and air commanders apprised of enemy intentions. In the case of SIGINT, timely warning provided directly to pilots undoubtedly contributed to the lopsided F-86 to MiG-15 kill ratio. During the Vietnam War, airborne ISR forces repeated their success of the Korean War. They constructed similar dissemination and direct threat systems that allowed the timely, accurate delivery of intelligence directly to ground and air commanders.

Understanding their effort had not been perfect, following the Vietnam War, ISR airmen endeavored to improve their tactical support ability. In an attempt to shorten the intelligence delivery chain, they created digital data links that would allow multiple users the ability to "see" intelligence and radar information simultaneously. This eliminated the reliance on relay centers as was done in both Korea and Vietnam. Additionally, ISR airmen undertook a diligent effort to ensure the ability to communicate via voice directly with the warfighters. Too often during the previous wars, airborne ISR forces possessed threat information that may have saved lives, but were unable to communicate it quickly enough. After rigorous coordination with ground and air components, airborne ISR platforms were equipped with a myriad of radio communications that enabled them to communicate directly with the warfighter. No longer would either situational awareness or threat warning have to be relayed by a third-party.

When Operation Desert Storm began in 1991, airborne ISR forces had truly evolved. They now possessed the ability to see and hear the

enemy and to subsequently communicate that information in near real-time to the people that needed it. Additionally, they were still able to conduct their strategic intelligence mission. Airborne ISR's flexibility allowed it to be effective at both strategic and tactical intelligence collection.

Lessons and Implications

In essence, the main lesson that results from the evolution of airborne ISR is that the intelligence it provides has become an integral part of militaries around the world. ISR is ingrained to such an extent that the days when intelligence was viewed as simply a force enhancer are long gone; today, airborne ISR *is* operations. The study of its evolution reveals the travails undertaken over nearly 200 years to arrive at today's capability. The principal message is that military leaders cannot let the capability atrophy. Following the two world wars, the military nearly abandoned airborne ISR. Despite the monumental achievements it had gained, postwar fiscal austerity, return to isolationist attitudes, and interservice rivalry led to airborne ISR's complete marginalization. When war struck, whether in 1941 or 1950, the military found its airborne ISR forces woefully unprepared. In both cases, a slow build up resulted in eventual successes, but during each build up, the United States intelligence community was reliant on other nations for the preponderance of its intelligence. This thesis' analysis serves to highlight the importance of maintaining airborne ISR skills and capabilities. Following the Korean War, airborne ISR did not atrophy, and when needed in Vietnam, it was ready. This momentum continued through Operation Desert Storm and endures today. As the USAF enters another postwar period following withdrawal from Iraq and, in 2014, Afghanistan, ISR strategists must remember this lesson.

Today's airborne ISR fleet is extensive. Since 2001, the United States military has greatly expanded its capacity. On the morning of 11 September 2001, there were fewer than 100 RPAs in the entire

inventory.[1] As of this writing, there are more than 6,000. While the United States Army owns the overwhelming majority of the RPAs, the USAF airborne ISR enterprise now relies more heavily on RPAs than it does manned aircraft. According to the latest figures, the USAF now has 174 General Atomics MQ-1 Predator, 54 General Atomics MQ-9 Reaper, and 25 Northrup Grumman RQ-4 Global Hawk aircraft as compared to only 22 RC-135s, 32 U-2s, and 18 E-8 JSTARS aircraft.[2] The recent addition of 37 of the USAF's newest airborne ISR aircraft, the MC-12W Project Liberty, brings the grand total of manned airborne ISR aircraft to 109.

While the USAF now possesses an extremely large airborne ISR capability, to avoid repeating the mistakes of the past, airborne ISR strategists must continue to promote the necessity of maintaining the force. The future is uncertain. Debate rages whether the last ten years of irregular warfare herald a change in the character of war or if the counterinsurgency (COIN) fights in Iraq and Afghanistan were mere aberrations. Followers of the latter argument advocate for a return to a strategic intelligence focus while supporters of the former argue for a tactical intelligence focus and a larger investment in advanced RPAs. Proponents of both views present impassioned arguments. Whoever is correct, however, is almost irrelevant to future USAF airborne ISR strategy. Long-term thinkers must consider both arguments and posture an airborne ISR force that is able to provide both tactical and strategic intelligence. Balancing the force to ensure successful intelligence collection in both types of conflicts is the challenge for today's ISR strategist.

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[1] Larry Greenemeier, "The Drone Wars: 9/11-Inspired Combat Leans Heavily on Robot Aircraft," *Scientific American*, 2 September 2011, http://www.scientificamerican.com/article.cfm?id=post-911-military-tech-drones (accessed 5 April 2012).
[2] "The Air Force in Facts and Figures," *Air Force Magazine* 94, no. 5 (May 2001): 48.

This argument about the character of modern war creates an additional challenge for airborne ISR forces. The strategic airborne ISR force developed during the Cold War was designed to operate in a permissive environment as was today's fleet of RPAs.[3] While the USSR certainly interfered with the PARPRO flights along its periphery, by and large, it permitted the United States to conduct strategic intelligence collection. The RPA expansion was also empowered by permissive airspace. Since October 2001 in Afghanistan and March 2003 in Iraq, Coalition air forces have operated with impunity. RPAs and the MC-12W matured in this environment. While future USAF support to COIN will typically occur in uncontested airspace, this will certainly not be the case if the United States is to face a near peer. Today's current airborne ISR aircraft – both manned and unmanned – are unable to operate in non-permissive environments. The challenge for airborne ISR strategist is to advocate for future capabilities that provide the ISR enterprise the ability to conduct operations in denied space.

The tactical support now provided by the RC-135 and the U-2 in Afghanistan is unprecedented. As highlighted earlier, both platforms communicate directly with ground forces providing both threat warning and enemy information in near real-time. The provision of intelligence directly to the warfighter is now a fundamental capability of both platforms and one on which the warfighter greatly depends. As United States ground forces have also matured in the permissive environment, the reliance on persistent airborne ISR has become almost second-nature. In future contested environments, with the current airborne ISR force, this capability will simply not exist. ISR strategists – and ground forces – need to plan for this future. Developing an airborne capability, likely unmanned, that is able to operate in non-permissive environments must be a high priority as the USAF moves forward.

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[3] Though the U-2 was initially designed to directly overfly contested airspace, modern air defenses quickly relegated the U-2 to permissive environments.

As this thesis has proven, the flexibility of manned airborne ISR is one of its major advantages over other types of ISR. While RPAs provide limited flexibility, their predominately short loiter periods and limited ranges greatly restrict their applicability – particularly if tasked to provide strategic intelligence collection. If the current airborne ISR force is to service both strategic and tactical intelligence requirements, ISR strategists must consider the need to expand the manned portion of the airborne force. Far-flung adversaries and the unpredictability of the international system demand an airborne ISR force that is ready to respond at a moment's notice; only manned airborne ISR provides the flexibility to rapidly deploy to the world's hot spots.

Another major lesson this thesis has uncovered concerns the general difference between strategic and tactical intelligence collection and the ramifications conducting both types has on the airborne ISR force itself. While the USAF has built a commendable airborne ISR aircraft capability, it has given too little attention to the people who are responsible for the analysis of the collected information. Traditionally-strategic airborne ISR airmen – like those who fly on the RC-135 or prosecute the collection from the U-2 – have increasingly been thrown into tactical intelligence roles. The USAF trained these airmen to collect and analyze strategic intelligence. As mentioned above, the strategic intelligence cycle is much slower than the tactical intelligence cycle. Asking our strategically-focused Airmen to bounce back and forth between both types of intelligence is dangerous as it creates a force that is proficient at neither. As the USAF moves into the post-COIN phase, it must give thought to this dilemma and seriously consider increasing the number of both linguists and analysts who prosecute airborne ISR missions. If traditionally-strategic platforms are to continue providing tactical support, they must be provided an adequate number of Airmen to do both missions properly. The exigencies of the conflicts in Iraq and Afghanistan have pulled the RC-135 and U-2 away from their

foundational missions. If the USAF intent is for these platforms to maintain the capability to do both strategic and tactical intelligence collection in the future, this requirement should also include an increase in personnel.

The final lesson the thesis has shown is that having a singularly focused airborne ISR force creates problems when that force is asked to do something outside of the norm. As USAF airborne ISR forces – particularly airborne COMINT forces – entered the Korean War, they were completely unprepared. They possessed no Korean linguists or analysts who focused on Korea. Additionally, their ISR aircraft were configured for strategic collection. Though it evolved, providing intelligence directly to the ground was impossible as the war began. The strategically-focused forces that began the war looked nothing like the tactically-focused ones that ended the war. This lesson must be remembered as the USAF moves forward. While no one can predict every problem the United States will face, ISR strategists must advocate for the maintenance of at least minimal competency against a wide variety of likely future enemies. Returning to a singular focus – as during the Cold War – will undermine the USAF's ability to provide valuable intelligence in other areas.

Ultimately, airborne ISR forces face considerable challenges as they move forward into a post-Iraq and Afghanistan phase. While the exigencies of COIN produced a large airborne ISR force, it is not one that is poised to operate in non-permissive environments or one that is postured to provide in-depth strategic intelligence. A return to the PARPRO missions of the Cold War seems likely for the traditionally-strategic airborne ISR collectors, but the linguists and analysts have been focused almost exclusively on tactical collection. As President Barack Obama recently signaled the shift from a Middle East focus to a

west Asia one, airborne ISR forces must also shift.[4] Since 1990, however, the preponderance of American airborne ISR has been focused on the Middle East; to shift to Asia will take time and training. Much like with the strategic-tactical difference above, however, USAF ISR airmen have the flexibility to make the transition; military leaders must give them the time.

[4] Margaret Talev, "Obama's Asia Pivot Puts U.S. Approach to China on New Path," *Bloomberg Businessweek*, 20 November 2011, http://www.businessweek.com/news/2011-11-20/obama-s-asia-pivot-puts-u-s-approach-to-china-on-new-path.html (accessed 31 March 2012).

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